COMMONWEALTH of VIRGINIA

Chesapeake Bay Nutrient and Sediment Reduction Tributary Strategy for the

Rappahannock River and Northern Neck Coastal Basins

Public Comment Draft

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I. Introduction and Background

This ***Chesapeake Bay Nutrient and Sediment Reduction Tributary Strategy for the Rappahannock River and Northern Neck Coastal Basins*** reflects a continuation of Virginia's commitment to improving local water quality and the water quality and living resources of the Chesapeake Bay. With its roots in the 1983 creation of the Chesapeake Bay Program the strategy builds on previous efforts and looks to shape actions in a large and diverse watershed over the next seven years and beyond. The reduction goals are far greater than any set before.

Developed as a partnership between natural resources agencies and local stakeholders, this strategy provides options for meeting ambitious reductions in nitrogen, phosphorus and sediment and outlines future actions and processes needed to maintain these levels in the face of a growing population and changing landscape.

Stretching from the Blue Ridge Mountains, through the Piedmont to the Chesapeake Bay, the challenges in developing a strategy for such a diverse watershed, and nearby coastal basins, were many. The streams, creeks and tidal marshes of the watershed encompass rolling farmland, growing urban and suburban development along the I-95 corridor and villages that draw much of their livelihood directly from the tidal waters. Their worth includes their bounty, beauty and recreational value, but also their connection to the history, tradition and quality of lands within the Rappahannock basin. This connection has fostered a common esteem and appreciation for the Rappahannock River that reaches from its headwaters to the mouth.

A successful nutrient and sediment reduction strategy will have significant impacts on water quality in the creeks, streams and rivers that feed the Rappahannock and nearby coastal embayments. Likewise, along with strategies being developed for other Bay tributaries in Virginia, Maryland, Pennsylvania, West Virginia, New York and Delaware, they will have a cumulative effect on the waters and living resources of the Chesapeake Bay.

The Bay is North America's most biologically diverse estuary, home to more than 3,600 species of plants, fish and animals. Approximately 348 species of finfish, 173 species of shellfish and more than 2,700 species of plants live in or near the Bay. It also provides food and shelter for 29 species of waterfowl, and more than one million waterfowl winter annually in the basin.

The plight and status of these species show that they will respond to the proper management practices. And that much still needs to be done.

A history of restoration

In the early 1980s, the Chesapeake Bay was a resource in severe decline. Water quality degradation played a key role in the decline of living resources in Bay and its tidal tributaries.

In 1983 the governors of Virginia, Maryland and Pennsylvania were joined by the mayor of Washington, D.C., the U.S. EPA administrator and the chairman of the tri-state legislative Chesapeake Bay Commission to sign an agreement working toward the restoration of the Chesapeake Bay. This agreement created a multi-jurisdictional, cooperative partnership known as the Chesapeake Bay Program. The program, sought to restore the Bay and its resources through cooperation and shared actions.

An over abundance of nutrients was identified as the most damaging water quality problem facing the Bay and its tributaries. High levels of nutrients, primarily phosphorus and nitrogen, over-fertilize the Bay waters, causing excess levels of algae. These algae can have a direct impact on submerged aquatic vegetation by blocking light from reaching these plants. More importantly, these algae have an indirect effect on levels of dissolved oxygen in the water. As algae die off and drop to the bottom, the resulting process of biological decay robs the surrounding bottom waters of oxygen, needed by oysters, fish, crabs and other aquatic animals.

The 1987 Bay Agreement recognized the role nutrients played in the Bay's problems and committed to reducing annual nitrogen and phosphorus loads into Bay waters by 40 percent by 2000. It was estimated that a 40 percent reduction would substantially improve the problem of low dissolved oxygen, which affects the Bay and many of its tributaries.

Nutrient reduction tributary strategies initiated

In 1992, Virginia joined her Chesapeake Bay Program partners in determining that the most effective means of reaching that water quality goal would be to develop tributary-specific strategies in each Chesapeake Bay river basin.

The tributary strategy approach is born of the realization that our actions on the land have a major impact on the waters into which they drain. This is particularly true in the 64, 000 square mile Chesapeake Bay watershed, where the ratio of land to water is 14:1. This approach also allowed stakeholders in each basin to address its mix of pollutants from point sources (i.e. wastewater treatment plants and industrial outflows) and nonpoint sources (runoff from farms, parking lots, streets, lawns, etc.).

Late in 1996 Virginia released its first tributary strategy, the *Shenandoah and Potomac River Basins Tributary Nutrient Reduction Strategy.* The result of more than three years of work, the strategy was developed cooperatively with local officials, farmers, wastewater treatment plant operators and other representatives of point sources and nonpoint sources of nutrients in the basin. As a result of the strong support for this grass-roots approach, the 1997 Virginia General Assembly adopted the Water Quality Improvement Act to provide cost-share funding for implementation of tributary strategies.

Released in December 1999, the initial strategy for the Rappahannock River and Northern Neck Coastal Basins identified water quality deficiencies and outlined a plan to reduce nutrient and sediment loadings into the Rappahannock and its tributaries based on previous nutrient and sediment reduction load goals. The strategy addressed a number of continuing processes and reevaluations along the way to achieving its goals.

The Rappahannock River Basin Commission and Rappahannock Conservation Council were deeply involved in the initial tributary strategy process. Both groups passed motions supporting the strategy. Also involved were citizens, local governments, soil and water conservation districts, Virginia Cooperative Extension, wastewater treatment plant operators, Friends of the Rappahannock, planning district commissions, the U.S. Army Corps of Engineers, the Natural Resources Conservation Service, the U.S. Fish and Wildlife Service, and Mary Washington College. Among these stakeholders, three implementation workgroups were established: the Development Impact Workgroup, the Rural Conservation Committee and the Education/Public Relations Workgroup.

Chesapeake 2000, A Watershed Partnership

While progress was being made in removing nutrients from the waters throughout the Chesapeake Bay watershed as the result of tributary strategies, nutrient enrichment remained a problem in the Bay's tidal waters. Beginning in 1998, the U.S. Environmental Protection Agency proposed implementation of a TMDL (Total Maximum Daily Load) regulatory program under Section 303(d) of the Clean Water Act to address nutrient-related problems in much of Virginia's Chesapeake Bay and tidal tributaries. In May 1999, EPA included Virginia's portion of the Bay and several tidal tributaries on the federal list of impaired waters based on failure to meet standards for dissolved oxygen and aquatic life use attainment.

In June 2000, members of the Chesapeake Executive Council signed a new comprehensive Bay Agreement. *Chesapeake 2000, A Watershed Partnership* is seen as the most aggressive and comprehensive Bay agreement to date. Designed to guide the next decade of Bay watershed restoration, *Chesapeake 2000* commits to "achieve and maintain the water quality necessary to support the aquatic living resources of the Bay and its tributaries and to protect human health." Meeting this commitment through a continuation of the Bay Program's voluntary, cooperative approach also alleviates the need for regulations to meet the same standards.

The new Bay agreement set out a process for achieving its water quality commitments that included setting increased nutrient reduction goals and the first Bay wide sediment reduction goals.

A living resources based approach

This cooperative effort has resulted in nutrient reduction goals that are much more protective than those agreed to in the past. Bay Program partners have agreed to base their success on the attainment of water quality standards, not simply pollution load reductions. These standards strive to meet established criteria for the Bay's designated uses. Bay partners chose designated uses based on living resources' habitat needs – shallow water, open water, deep water, deep channel and migratory and spawning areas.

For the first time, partners developed criteria that take into account the varying needs of different plants and animals and the various conditions found throughout the Bay. The criteria are:

- **Water clarity** – which ensures that enough sunlight reaches underwater bay grasses that grow on the bottom in most shallow areas.
- **Dissolved oxygen** – which ensures that enough oxygen is available at the right time during the right part of the year, to support aquatic life, including fish larvae and adult species.
- **Chlorophyll a** – the pigment contained in algae and other plants that enables photosynthesis. Optimal levels reduce harmful algae blooms and promote algae beneficial to the Bay's food chain.

In addition to being the focus for the reduction goals or allocations for tributary strategies, these criteria will serve as the basis for the revision of water quality standards for Virginia's tidal waters. This regulatory action is taking place simultaneously to the tributary strategy process. A notice of intended regulatory action (NOIRA), the first step in the regulatory process to amend water quality standards, was published in the Virginia Register on November 17, 2003. The Department of Environmental Quality is using a participatory approach, to more fully involve the public, in development of the new/revised tidal water quality standards. A Technical Advisory Committee of interested stakeholders has been formed and is meeting monthly. A set of draft water quality standards is expected for presentation to the State Water Control Board early this summer, with a request to release them to the public for review and comment. Final state adoption of the standards is scheduled by the end of 2005, to become effective in early 2006, after approval by the U. S. Environmental Protection Agency. More information on this process can be found at **http://www.deq.state.va.us/wqs/pdf/NOIRABay.pdf**

Using computer models to determine allocations

To determine optimal nutrient and sediment allocations, Bay watershed partners developed several simulations for analysis by the Chesapeake Bay Watershed and Water Quality models. Each simulation, or scenario, allows Bay scientists to predict changes within the Bay ecosystem due to proposed management actions taking place throughout the Bay's 64,000-square-milewatershed.

Information is entered into the Watershed Model, which details likely results of proposed management actions. These actions range from improving wastewater treatment technology to reducing fertilizer or manure application on agricultural lands to implementing improved land use programs to planting streamside forest buffers.

Next, these results are run through the Bay Water Quality Model, a complex mathematical model that provides Bay scientists with a visualization of future Bay and river water quality conditions resulting from each scenario. Throughout the development of new Bay water quality criteria, more than 70 Water Quality Model runs were conducted.

As described above, the Chesapeake Bay Watershed and Water Quality models are powerful tools that help guide the level of effort and the types of actions needed to restore the health of the Bay and its tributaries. Understanding the strengths and limitations of these models is critical to efficiently and effectively targeting implementation efforts.

Estimating existing and future nitrogen and phosphorus loads is a key application of the watershed model. Incorporating good data and monitoring information, this model is well suited to provide these estimates.

Due, in part, to data limitations, sediment transport is simplified and sediment loads from eroding stream banks are not well captured. These limitations need to be addressed in future model versions. Moreover, these limitations need to be considered in determining ongoing implementation priorities. For example, storm water retrofits and stream restoration efforts may be more effective than is currently indicated by the model.

Regardless of certain limitations, the Chesapeake Bay Watershed and Water Quality models provide a good basis for making basing restoration decisions. Moreover, these models compliment and support other tools such as water quality assessment and watershed planning activities.

At the agreed to allocations, the model predicts that we will see a Bay similar to that in the 1950s. Proposed water quality standards will be met in 96 percent of the Bay at all times, and the remaining four percent would fall shy of fully meeting the proposed standards for only four months a year.

The resulting nutrient reduction goals, or allocations, call for Bay watershed states to reduce the amount of nitrogen entering the Bay and its tidal tributaries from the current 285 million pounds to no more than 175 million pounds per year, and phosphorus from 19.1 million pounds to no more than 12.8 million pounds per year. When coordinated nutrient reduction efforts began in 1985, 338 million pounds of nitrogen and 27.1 million pounds of phosphorus entered the Bay annually.

When achieved, the new allocations will reduce annual nitrogen loads by 110 million pounds and phosphorus by 6.3 million pounds from 2000 levels and will provide the water quality necessary for the Bay’s plants and animals to thrive.

The Virginia tributary strategy approach

Using the modeling process described, Bay Program partners then determined specific allocations for each major basin. Allocations for basins that cover more than one state were divided by jurisdiction.

The new nitrogen allocation for the Rappahannock is 5.24 million pounds per year, which requires a 34 percent decrease from the 2002 load of 7.9 million pounds. Total phosphorus in the river will be capped at 620,000 pounds, 35 percent less than the load of 954,000 pounds in 2002. The new sediment allocation of 288,000 is 14 percent lower than the 2002 level of 335,000 tons a year.

To reach these ambitious new reduction goals, the current tributary strategy must build on what has gone before, in particular the 1999 Rappahannock Nutrient Reduction Strategy. Many of the stakeholder groups involved in developing the previous strategy were active in working with state natural resource agency staff in crafting this nutrient and sediment reduction plan.

The strategy looks at the agricultural nonpoint source practices and wastewater treatment plant reductions that were critical to the 1999 plan to see where practices could be increased. This strategy also looks more closely at measures involving land use, urban nutrient management and stormwater management that will need to play key roles in meeting the new basin allocations.

This strategy identifies a number of nonpoint source best management practices (BMPs) and point source treatment levels that can be implemented to meet the Rappahannock and Northern Neck Coastal Basin's allocations. However, the strategy also recognizes the need for reduction efforts to grow and expand in order to meet the 2010 goal and to maintain or cap the allocation once it is achieved. In short, implementation planning that improves local water quality throughout the Chesapeake Bay basins will be a continuous process into the future.

In this regard the strategy outlines processes that need to be developed in order to facilitate implementation between now, 2010, and beyond. There will be annual progress updates and a more thorough, Bay-wide evaluation of advancement towards the 2010 goals when an updated version of the Watershed Model becomes available, which is expected in 2006.

Implementation planning, as outlined in this strategy, will be continually refined, addressing both point and nonpoint sources. It must identify roles and responsibilities for federal, state and local governments, the private sector, nonprofits and the average citizen. The strategy addresses the need to establish timeframes and make cost estimates, and identify potential funding sources.

Tributary strategy implementation will be an iterative process bringing greater consideration of water quality issues to many sectors in each community as time goes by. Recognizing how land use and lifestyle can impact water quality, and finding alternatives to reduce those impacts, are objectives of tributary strategies. Marketing social change of this magnitude is a challenge that Virginia will deal with steadily using a variety of approaches. Reaching millions of individuals with these messages will take time and money, and there must be enduring popular support among the citizens and elected leaders across the watershed.

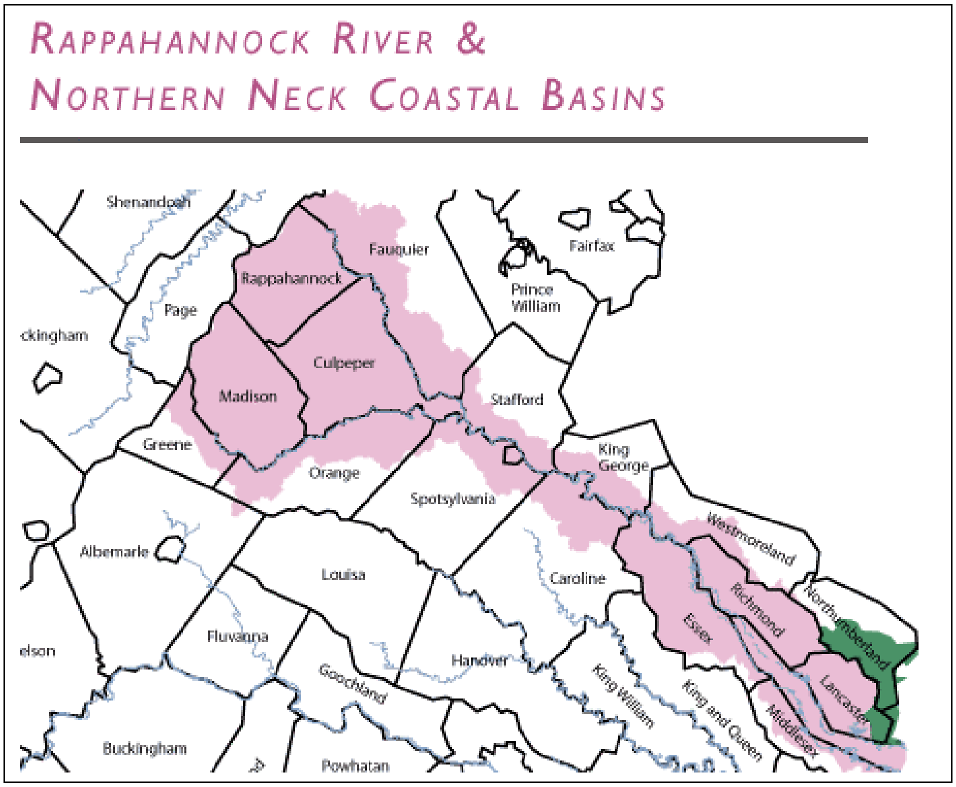
Ongoing tributary strategy implementation cannot be seen as a process that is separate from other ongoing water quality initiatives. In fact, tributary strategies should be seen as a way to connect and incorporate local water quality initiatives.

For example, many counties, some aided by local conservation nonprofit organizations, are developing local watershed management plans in their communities. These plans look at sub-watersheds of the tributary as a whole when planning new development or assessing other impacts on land and water resources. Planning at this scale reveals where individual BMPs are needed within each community in the basin. Locations for the many nonpoint source BMPs in the tributary strategy can be determined using this technique. These local watershed plans will play key roles as a part of the implementation for a basin wide tributary strategy.

In addition, Virginia's Chesapeake Bay Preservation Act program was established to improve water quality through the regulation of non-point source pollution from land development. Applicable to localities in the tidewater region (generally east of Interstate 95), the Act is a critical element of Virginia's multifaceted response to the Bay Agreement and established a unique cooperative program between state and local governments aimed at reducing nonpoint source pollution. The Bay Act was designed to improve water quality in the Bay and tributaries through wise resource management practices. Since the program recognized that the primary responsibility for land use decisions in Virginia lies with local governments, the Act expanded local government authority to manage land development practices to improve water quality. Through land use ordinances and comprehensive plans, local Bay Act Programs address nonpoint source pollution by identifying and preserving environmentally sensitive areas, identified as Chesapeake Bay Preservation Areas or Resource Management Areas. Performance Criteria such as minimizing impervious cover and land disturbance, preserving vegetation, septic pump out requirements, stormwater management requirements, erosion and sediment control requirements, agricultural conservation plans, forestry best management practices, etc are required in these Chesapeake Bay Preservation or Resource Management Areas. The Act and associated local government planning may be incorporated into the locality's overall efforts to implement the Tributary Strategy.

Likewise, mandated plans to restore stream segments on the federal impaired waters list, known as TMDLs (Total Maximum Daily Loads) can also be part of a larger tributary strategy. These TMDLs deal with stream segments that violate water quality standards for specific impairments such as bacteria, pH or dissolved oxygen. They do not specifically address nutrient or sediment impairments. However, the implementation plans for upstream TMDLs will also lessen nutrient and sediment loads. So, those measures included in TMDL implementation may be incorporated into the larger tributary strategy for that river basin.

II. The Rappahannock River Watershed



Rappahannock Watershed Fast Facts

- *Drainage Area in Acres: 1,736,679*
- *Square Miles: 2,713.6*
- *6.35 percent of Virginia's land base*
- *Length: 184 miles*
- *Counties: 15*
- *Cities: 1 (Fredericksburg)*
- *2000 Population: 255,558*
- *Headwaters: In Rappahannock and Fauquier counties*
- *Larger Tributaries: Cat Point Creek, Corrotoman River, Hazel River, Mountain Run, Piscataway Creek, Rapidan River, Robinson, Thornton River*
- *Land Use: 60 percent forest, 28 percent agriculture, 6 percent urban.*

Major pollutants

The three major pollutants targeted in the tributary strategy process are nitrogen, phosphorus and sediment. Approximately 93 percent of nitrogen and phosphorus in the Rappahannock River watershed originate from nonpoint sources. Most nonpoint source pollutants come in stormwater runoff from agricultural lands, residential lands and other urban areas. The other seven percent comes from point source discharge sites. Soil erosion is considered 100 percent nonpoint source related. It comes mainly from construction sites and stream banks. Chronic erosion, siltation and bank instability are particularly prevalent in the western portion of the watershed.

Water quality impacts from excessive inputs of nutrients and sediment include low levels of dissolved oxygen near the mouth of the Rappahannock and diminished acreage and health of underwater grasses throughout the tidal portion of the river.

This section presents a very general overview of selected water quality conditions in the Rappahannock. A more detailed water quality analysis for the Rappahannock may be found in Appendix A. In addition, a much more comprehensive status and trends reports are available for each major Bay basin available through the DEQ Chesapeake Bay Program Internet webpage www.deq.state.va.us/bay/wqifdown.html and the DEQ Water Programs' Reports webpage www.deq.state.va.us/water/reports.html.

Water quality conditions are presented through a combination of the current status and long-term trends for nitrogen, phosphorus, chlorophyll, dissolved oxygen, water clarity, and suspended solids. These are the indicators most directly affected by nutrient and sediment reduction strategies. Environmental information regarding other important conditions in Chesapeake Bay (e.g., underwater grasses, fisheries, chemical contaminants) are available in the 2004 biennial report, "Results of Monitoring Programs And Status of Resources", available via the webpage for the Secretary of Natural Resources at www.naturalresources.virginia.org.

The status of nitrogen in much of the Rappahannock River is considered relatively good, in comparison to conditions in the other major tributaries and the Virginia Chesapeake Bay. As for phosphorus, several watershed input stations show improving concentration trends, but unfortunately an improving trend at the Rappahannock watershed input station noted in a previous report was no longer present when the 2003 data were added to the analyses. Parts of all of the major Virginia tributaries, including the Rappahannock, have poor status in relation to Bay-wide conditions. A degrading trend in chlorophyll was detected in the upper tidal fresh portion of the Rappahannock.

The lower Rappahannock River and northernmost Virginia Chesapeake Bay segments are indicated as poor or fair status, partly because of low dissolved oxygen concentrations found in the mid-channel trenches. These mid-channel trenches have naturally lower dissolved oxygen levels, but the area affected and duration of low dissolved oxygen levels has been made worse by anthropogenic nutrient inputs. Status of water clarity at many segments within the tributaries and the Chesapeake Bay mainstem are fair or poor, including the tidal fresh and middle portions of the Rappahannock. This suggests that poor water clarity is one of the major environmental factors inhibiting the resurgence of underwater grasses in Chesapeake Bay. Degrading trends in water clarity were detected over a wide geographic area within Virginia's tributaries and Chesapeake Bay, including the Corrotoman basin. The status of suspended solids is fair or poor in segments of all of the major Virginia tributaries, including the tidal fresh portion of the Rappahannock. No statistically significant trends were detected in the Rappahannock.

Demographics and land use

The Rappahannock River basin is located in northeastern Virginia between the Blue Ridge Mountains and Chesapeake Bay. The basin is bordered by the Potomac River basin to the north and west, and the York and James River basins to the south. The basin extends across the Appalachian, Piedmont, and Coastal Plain physiographic provinces, covering an area of 2,714 square miles or 1,736,679 acres. The Rappahannock basin contains 2,616 miles of rivers and streams, 690 acres of lakes, and 127 square miles of tidal estuaries.

Topography in the basin varies from steep in the western portion to flat in the eastern portion, as the headwaters lie in Rappahannock and Fauquier counties, in the Appalachian province and the river flows to the southeast, entering the Chesapeake Bay between Lancaster and Middlesex counties. Embrey Dam, located near the Rappahannock fall line, was breached in February 2004 with final removal to take place by 2006. The removal of the dam gives migratory fish species an unobstructed spawning route and will enhance the recreational use of the river.

The Rappahannock watershed is comprised of 15 counties and one city. Six counties make up the Upper portion of the basin and nine counties and the City of Fredericksburg, which is right at the fall line, make up the lower portion. Fredericksburg, the only city within the watershed, is located on the I-95 corridor. According to 2000 census data, the Fredericksburg metropolitan area is one of the fastest growing regions in Virginia and the United States. It is expected that the entire basin will continue to experience the rapid growth that it has had in the last several years (See Figure 1 for Population Density Trends). However, in spite of this rapid development, the vast majority of the basin remains primarily agricultural and forested.

As noted in the charts below (Figures 2-4) the Rappahannock watershed will see only minimal land use changes between 2000 and 2010. Both the upper and lower portions of the Rappahannock watershed will lose agricultural land due to the growth experienced in the urban and mixed open source categories. However, acreage of forested land remains relatively stable and appears to be increasing in the lower watershed.

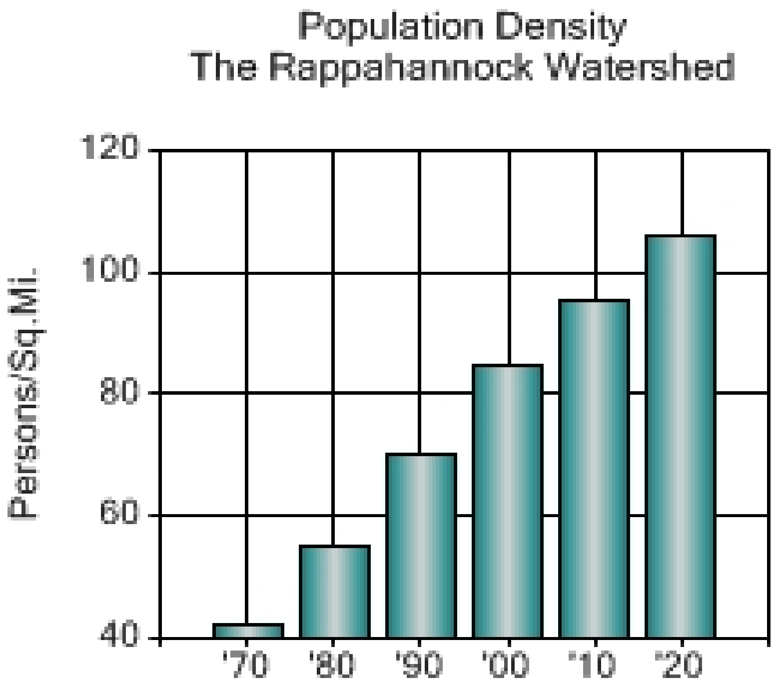


Figure 1

Source: Chesapeake Bay Program

Figure 2: 1985 Land Use in the Rappahannock Watershed

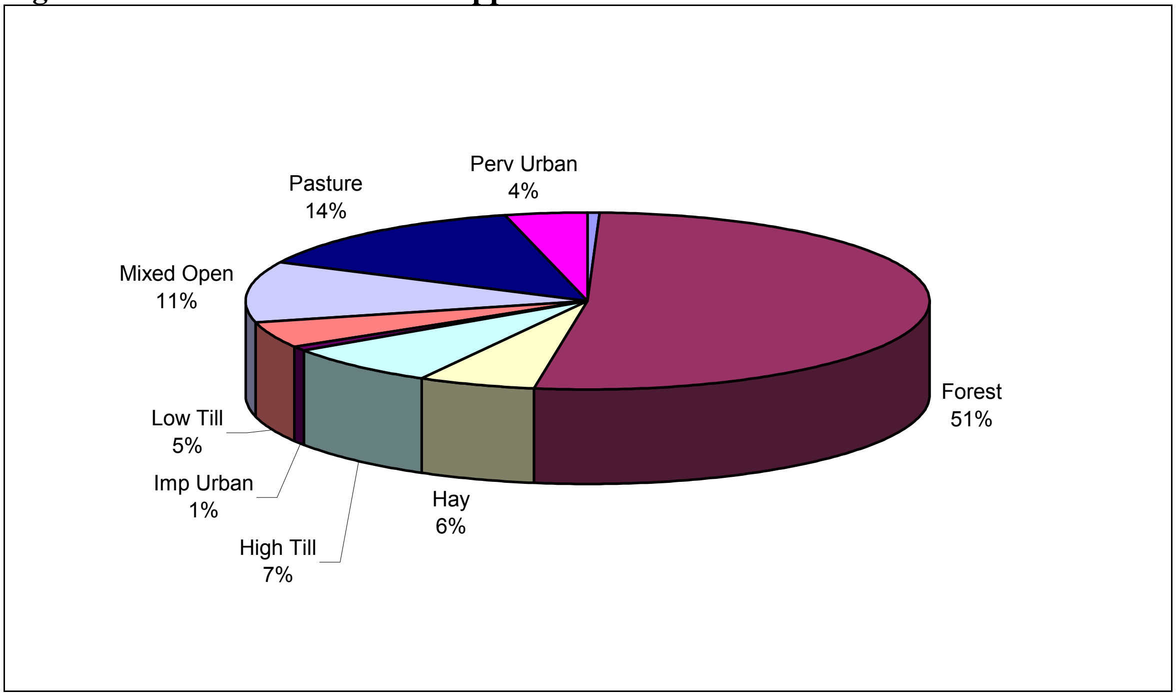


Figure 3: 2002 Land Use in the Rappahannock Watershed

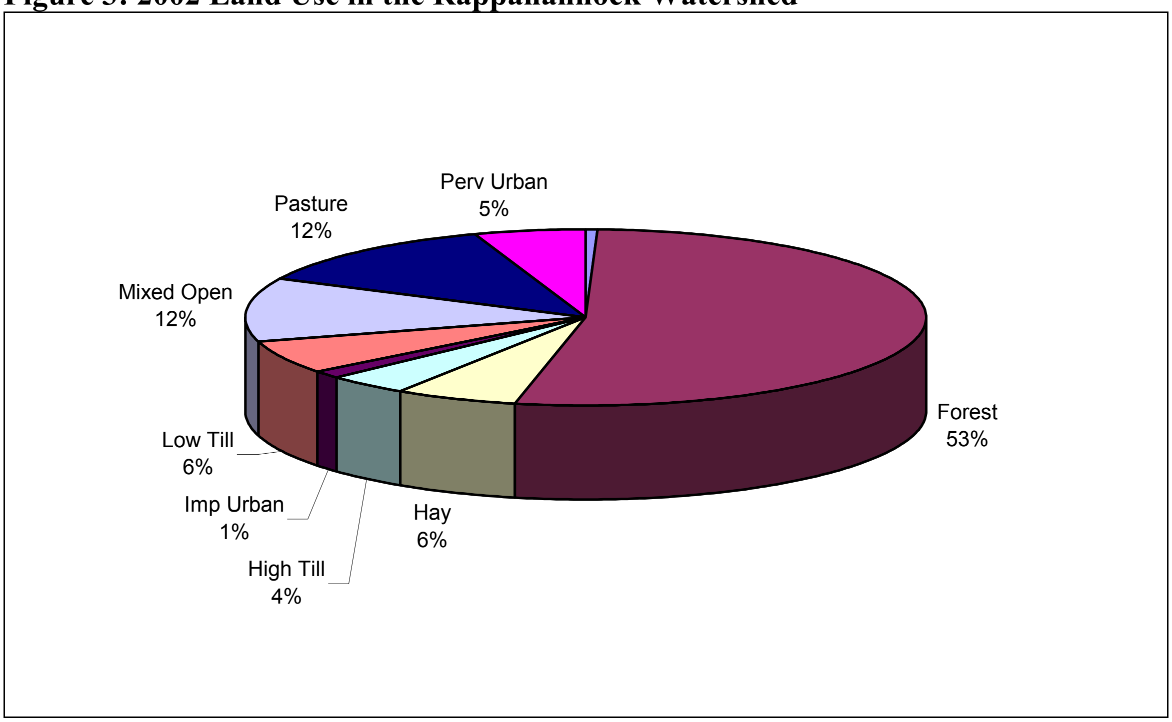
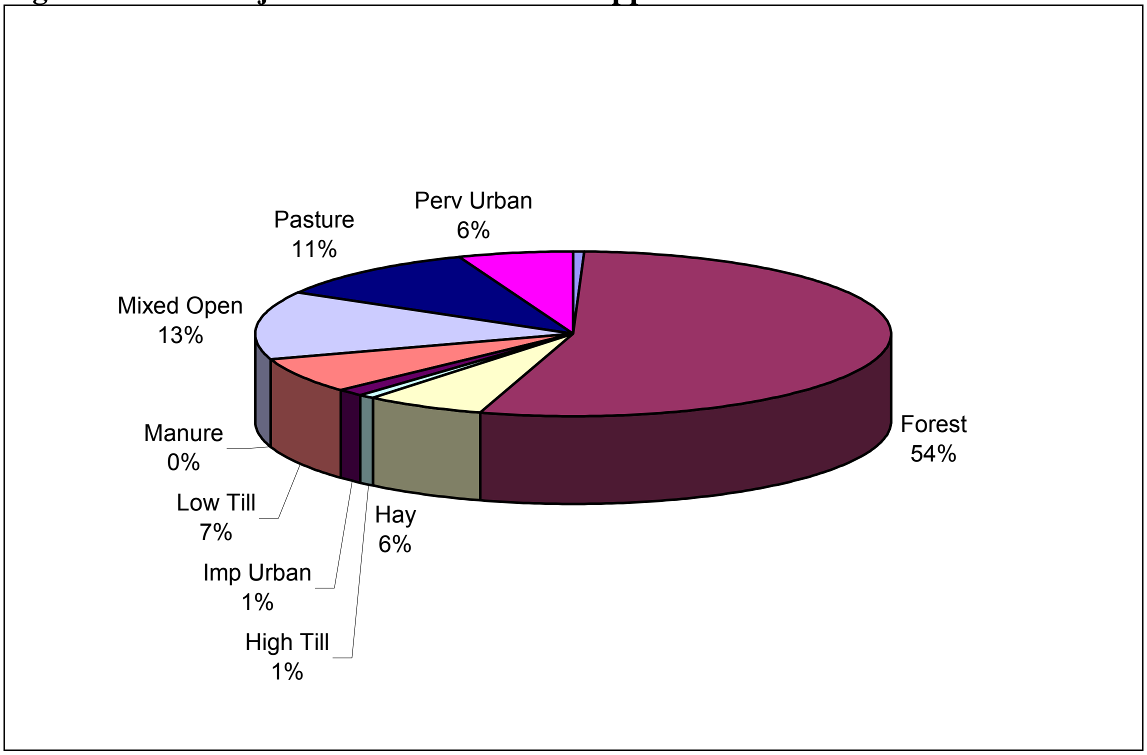


Figure 4: 2010 Projected Land Use in the Rappahannock Watershed



III. Strategy Practices and Treatments

Nutrient and sediment allocations and nutrient reduction goals

The Rappahannock strategy is one of five developed for Virginia's Chesapeake Bay basins. While each basin had specific nutrient and sediment load allocations to reach, they are a part of overall Virginia Chesapeake Bay nutrient and sediment reduction goals. As the result of the efforts by state staff and stakeholders in all five basins Virginia has crafted a series of strategies that surpassed Virginia's nitrogen, phosphorus and sediment goals.

Table 1: Allocations and Scenarios by Basin and Statewide

	TN (LBS/YR)		
	2002 Progress	2010 VA Strategy	2010 Cap Load Allocation
Potomac	22,844,023	12,589,458	12,839,755
Rappahannock	7,899,245	5,309,703	5,238,771
York	7,679,383	5,362,111	5,700,000
James	37,258,742	24,518,310	26,400,000
Eastern Shore	2,122,892	948,292	1,222,317
VA TOTAL	**77,804,285**	**48,727,874**	**51,400,843**
	TP (LBS/YR)		
	2002 Progress	2010 VA Strategy	2010 Cap Load Allocation
Potomac	1,951,741	1,176,908	1,401,813
Rappahannock	954,358	692,870	620,000
York	749,445	538,103	480,000
James	5,952,375	3,486,427	3,410,000
Eastern Shore	227,205	86,734	84,448
VA TOTAL	**9,835,124**	**5,981,043**	**5,996,261**
	SED (TONS/YR)		
	2002 Progress	2010 VA Strategy	2010 Cap Load Allocation
Potomac	720,462	403,221	616,622
Rappahannock	335,183	247,000	288,498
York	126,987	97,999	102,534
James	1,174,351	791,403	924,711
Eastern Shore	22,036	8,002	8,485
VA TOTAL	**2,379,018**	**1,547,624**	**1,940,849**

Strategy development

As soon as nutrient and sediment allocations were received, stakeholder teams were formed in each of Virginia's major Chesapeake Bay tributary basins to guide and assist in preparing a strategy to meet the ambitious allocations. Efforts were made to ensure that the tributary team formed was representative of the diverse stakeholder interests in this sizeable watershed. Team representatives include citizens, farmers, soil and water conservation districts, private industry, environmental groups, wastewater treatment plant operators, and local, state, and federal government agencies from both nonpoint and point sources of nutrient pollution. A complete listing of members and affiliations may be found in the appendix.

Team members worked with state staff to review existing conditions in their basin in recommending a mix of nonpoint source practices and point source treatment levels. In their work they considered the existing structure, responsibilities and workload of the governmental and private entities that would be involved in implementing these practices. They worked within the framework of existing state laws, regulations and authorities. Even assuming optimal funding their initial mix of practices came up short of the basin's nutrient and sediment load allocations.

State staff then took the stakeholders work and added practices and treatments using as its only restrictions existing technologies, land availability, animal units and other variables related only to the practices themselves. They did not factor in government responsibilities, infrastructure or availability of funding.

This analysis showed that it is feasible to meet the imposing allocation goals set for each basin. However, it also showed that considerable analysis of the barriers to implementation need to be explored and addressed. This document will begin that exploration in Section IV.

Scenario Results

As indicated in Table 2, the Rappahannock falls short of the nitrogen and phosphorus goals, while the sediment goal has been met. For comparison purposes, the table also includes loadings from 2002 and 1985.

Table 2: Rappahannock Cap Allocations and 2010 Scenario

		All Sources	NPS	PS
TN (lbs/yr)	Cap Allocation	5,238,771		
	Tributary Strategy	5,309,703	4,831,929	477,765
	2002 Progress	7,899,245	7,360,779	538,466
	1985	9,794,002	9,266,124	527,878
TP (lbs/yr)	Cap Allocation	620,000		
	Tributary Strategy	692,870	652,042	40,829
	2002 Progress	763,070	698,652	64,418
	1985	1,277,672	1,084,092	193,580
Sed (tons/yr)	Cap Allocation	288,000	288,000	
	Tributary Strategy	247,000	247,000	
	2002 Progress	263,172	263,172	
	1985	417,914	417,914	

As shown above, overall Virginia's reduction strategy met the reductions, while there were minor shortages at individual rivers, namely the Rappahannock. However, these discrepancies are generally within the model's margin of error, both above and below the cap allocations for nitrogen, phosphorus and sediment. In addition, the sediment goal was far exceeded, due to the interrelated nature of nitrogen, phosphorus, and sediment. Most of the practices defined in this strategy generally achieve reductions in all three constituents.

The tributary strategy relies on a suite of best management practices (BMPs) covering all land use categories, although it includes high implementation of specific practices that have significant impacts on water quality, are cost effective, and/or are regionally popular. As outlined below and in Table 3, a large part of the strategy relies upon significant load reductions on agricultural lands, primarily cropland. Additionally, upgrades at point source facilities will contribute to the load reductions, especially phosphorus reductions.

Nonpoint Source Input Deck summary

For the agriculture source category, the BMPs in the input deck focused on animal waste management systems, land conversion BMPs such as riparian forest buffers on cropland, hay and pasture (five percent of available cropland acres converted to forest buffers and 2.5 percent of hay land and pasture converted to forest buffers) and grass buffers on cropland (five percent of available acres converted to grass buffers). Other land conversion BMPs that were targeted included wetland conversion, tree planting (five percent of cropland converted to tree planting, one percent of hay converted to tree planting, and one percent of pasture converted to tree planting), and retirement of highly erodible cropland (2.5 percent was retired). These land conversion BMPs have a greater effect on nitrogen, phosphorus, and sediment reductions with higher "pounds reduced per acre." In addition, stream protection practices (off-stream watering with fencing, off stream watering without fencing, and off-stream watering with fencing and rotational grazing) were targeted.

The agronomic practices such as conservation tillage, cover crops, nutrient management and farms plans were maximized, with 75 percent of the cropland in cover crops and 90 percent in conservation tillage. Farm plans were applied to 90 percent of the cropland, hay and pasture acres and nutrient management was applied to 90 percent of cropland and hay acres. These practices are very cost effective and unlike the land conversion BMPs, multiple practices can be applied to a given acre, which helps to increase the nutrient and sediment reductions.

The BMPs targeted for the mixed open land use included forest buffers and nutrient management planning. Nutrient management planning was applied to 90 percent of the mixed open acres and forest buffers were applied to 2.5 percent of the mixed open acres.

For the urban source category the stormwater BMPs that were targeted included wet ponds and wetlands, infiltration and filtering practices. These practices are more desirable than dry detention ponds and dry extended ponds because of higher nutrient removal. Forest buffers were applied to 2.5 percent of the pervious urban acres. Nutrient management was applied to 90 percent of the pervious urban acres after accounting for the land conversion practices mentioned above.

Forest harvesting practices were applied to the forestland use category. The acres treated by forest harvesting practices were based on reported data provided by the Virginia Department of Forestry.

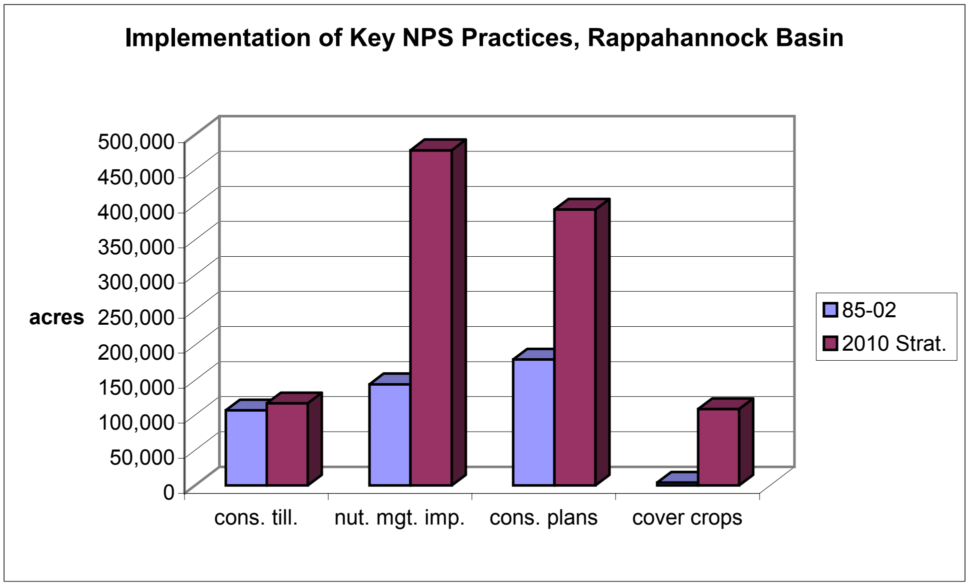
The BMPs that were applied to the septic source category included septic tank pump outs, and septic denitrification systems. The Chesapeake Bay Program provided projections as to the number of septic systems in operation by 2010. A septic tank pump out rate of 75 percent was used to calculate the number of pump outs. Generally a 10 percent conversion to septic denitrification was applied, this would include retrofits of existing systems and new construction.

Table 3: Rappahannock Nonpoint Source Input Deck

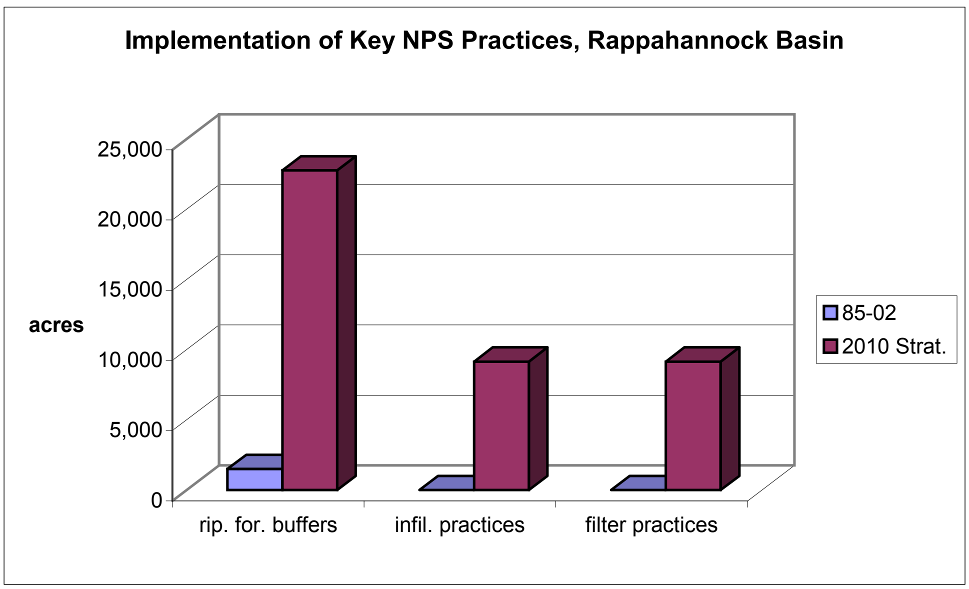
Best Management Practice	Units	Amount
AGRICULTURAL PRACTICES:		
Animal Waste Management Systems/Barnyard Runoff Control	acres	53
Conservation Plans	acres	393,351
Conservation Tillage	acres	117,028
Cover Crops (early planting)	acres	108,936
Forested Buffer	acres	15,507
Grassed Buffer	acres	7,882
Horse Pasture Management	acres	9,359

Retirement of Highly Erodible Land	acres	3,940
Nutrient Management Plans	acres	222,767
Off-Stream Watering with Fencing	acres	37,907
Off-Stream Watering without Fencing	acres	18,954
Off-Stream Watering with Fencing and Rotational Grazing	acres	37,907
Tree Planting	acres	10,932
Wetland Restoration	acres	0
Yield Reserve	acres	1,048
NON-AGRICULTURAL PRACTICES:		
Erosion and Sediment Control	acres	8,436
Filtering Practices	acres	9,157
Forested Buffer	acres	7,273
Forest Harvesting Practices	acres	1,747
Infiltration Practices	acres	9,157
Mixed Open Nutrient Management Plans	acres	194,255
Septic Connections	acres	0
Septic Denitrification	acres	4,637
Septic Pumping	acres	34,780
Tree Planting	acres	0
Urban Nutrient Management Plans	acres	60,978
Wetland Restoration	acres	0
Wet Ponds and Wetlands	acres	6,787

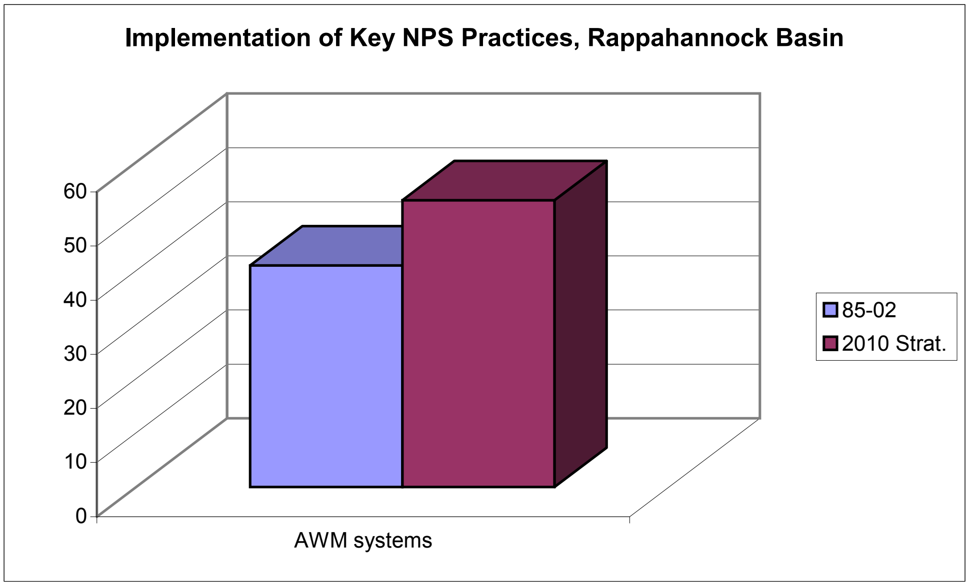
The following bar charts compare implementation rates from the seventeen year 1985 to 2002 time period with those the strategy calls for during the seven years through 2010 for several key nonpoint source best management practices in the York River basin. Implementation rates for all of these practices, and many others, will need to increase dramatically. Practices that are already heavily used will still need to be increased. In some cases the strategy calls for practices that have previously seen little or no implementation in the basin. While the strategy looked at the whole suite of BMPs available, there are a few practices in each basin that are not being used. In these cases either land use or some other condition did not make that particular BMP applicable to that basin. However every effort was made to identify and maximize the use of all applicable practices.



Implementation of Key NPS Practices, Rappahannock Basin
500,000
450,000
400,000
350,000
300,000
250,000
200,000
150,000
100,000
50,000
0
acres
cons. till.
nut. mgt. imp.
cons. plans
cover crops
85-02
2010 Strat.



Implementation of Key NPS Practices, Rappahannock Basin
25,000
20,000
15,000
10,000
5,000
0
acres
rip. for. buffers
infil. practices
filter practices
85-02
2010 Strat.



Point Source Input Deck summary

The point source control levels proposed for the Rappahannock facilities would result in annual discharged loads of approximately 534,570 pounds of nitrogen and 39,700 pounds of phosphorus, in the year 2010. Although point sources currently account for less than 10 percent of the total nitrogen load delivered to the tidal Rappahannock, a tributary strategy loading allocation was established that held the point source load steady in the face of rising flows from the wastewater plants. While there are many combinations of treatment levels for the affected significant facilities that could reach these load levels, for simplicity and equity the input deck assumed uniform nutrient reduction treatment at municipal plants grouped within sub-basins, and equivalent controls at the one industrial plant. The municipal plants located west of the fall line (in the non-tidal portion of the watershed) would achieve annual averages of 8 mg/l nitrogen and 0.5 mg/l phosphorus, coupled with projected flow levels for the year 2010. The plants discharging into the tidal portion of the river would achieve annual averages of 6.3 mg/l nitrogen and 0.5 mg/l phosphorus, coupled with projected flow levels for the year 2010; the industrial plant would reduce its current nitrogen and phosphorus concentrations by 50 percent.

This scenario does not set load allocations for each individual plant -- what is sought is an aggregate point source load across the entire Rappahannock basin that the plants would maintain into the future. The process for setting the individual plant allocations, and procedures to establish numerical discharge permit limits for nutrients will be informed and assisted under a rulemaking now underway to revise the State Water Control Board's "Point Source Policy for Nutrient Enriched Waters". Information on revising this regulation can be found on the DEQ Chesapeake Bay Program's webpage, at this Internet address: www.deq.state.va.us/bay/multi.html.

Table 4: Rappahannock Point Source Input Deck

Facility	WSM Segment	Design Flow	Trib Strat 2010 Flow*	Trib Strat TN Conc	Proposed 2010 TN Load (lbs)	Trib Strat TP Conc	Proposed 2010 TP Load (lbs)
Culpeper STP	230	4.50	2.27	8.0	55,310	0.50	3,457
Orange STP	230	1.50	0.69	8.0	16,812	0.50	1,051
Rapidan STP	230	0.60	0.12	8.0	2,924	0.50	183
Remington STP	230	2.00	0.75	8.0	18,274	0.50	1,142
South Wales STP	230	0.90	0.25	8.0	6,091	0.50	381
Warrenton STP	230	2.50	1.18	8.0	28,752	0.50	1,797
Wilderness Shores	230	0.75	0.70	8.0	17,056	0.50	1,066
Subtotal 230 =		12.75	5.96		145,219		9,076
FMC STP	560	5.40	3.40	6.3	65,550	0.50	5,178
Ft. A.P. Hill STP	560	0.53	0.12	6.3	2,314	0.50	183
Fredericksburg	560	3.50	2.50	6.3	48,198	0.50	3,807
Haymount STP	560	0.95	0.50	6.3	9,640	0.50	761
Haynesville Correct. Ctr. STP	560	0.23	0.16	6.3	3,085	0.50	244
L. Falls Run STP	560	4.00	4.48	6.3	86,371	0.50	6,822
Massaponax STP	560	8.00	6.60	6.3	127,244	0.50	10,051
Montross STP	560	0.10	0.05	6.3	964	0.50	76
Tappahannock	560	0.80	0.45	6.3	8,676	0.50	685
Urbanna STP	560	0.10	0.10	6.3	1,928	0.50	152
Warsaw STP	560	0.30	0.22	6.3	4,241	0.50	335
Subtotal 560 =		23.91	18.58		358,210		28,295
Omega Seafood*	580	--	3.23	7.5	25,549	0.55	1,891
Reedville STP	580	0.20	0.04	6.3	771	0.50	61
Subtotal 580 =		0.20	3.27		26,320		1,952
Kilmarnock STP	930	0.50	0.25	6.3	4,820	0.50	381
Subtotal 930 =		0.50	0.25		4,820		381
Totals =		37.36	24.83		534,570		39,703
NOTE: * loads based on multiple outfalls and less than 365 days annual operation (seasonal only)							

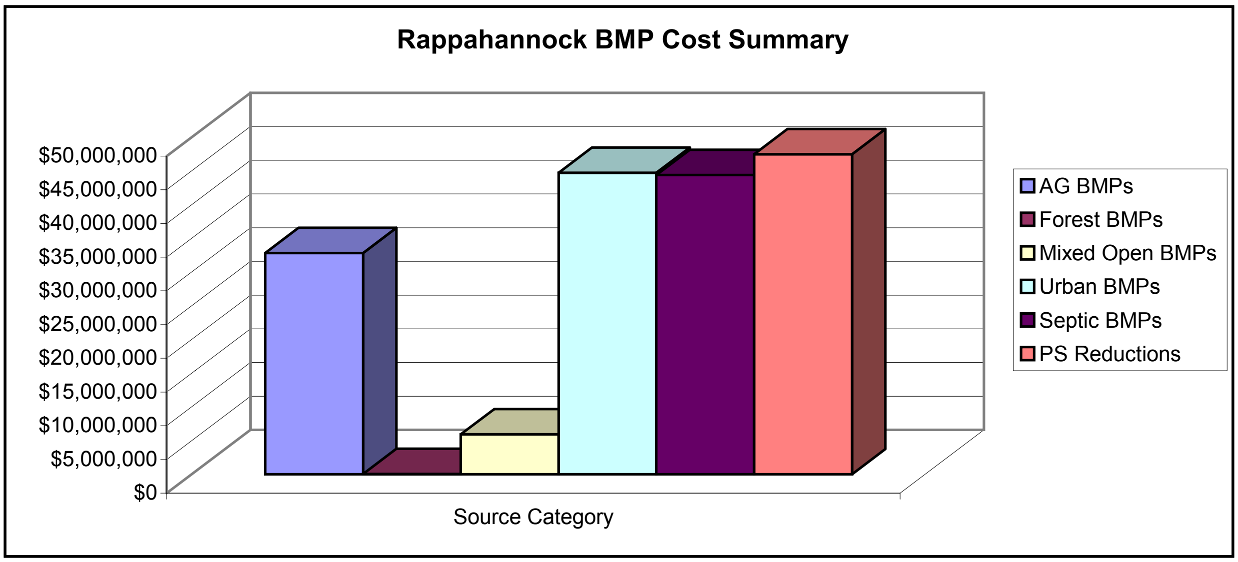
As outlined in Table 4, there are many treatment level combinations for the affected significant facilities that could achieve the desired load reductions in each basin. For simplicity and equity the point source nitrogen and phosphorus discharge levels proposed for each tributary basin generally assume uniform nutrient reduction treatment at the municipal plants, and equivalent controls at the industrial plants. However, this may not be the most cost effective or appropriate means of achieving the desired water quality objectives. Therefore, this scenario does not set load allocations for each individual plant. For a more detailed analysis of the point source input deck, please see Appendix C.

Cost estimates

The total estimated cost to implement the tributary strategies for the Virginia portion of the Chesapeake Bay is $3.2 billion. For the Rappahannock basin the estimate is $191 million. These estimates include point sources, nonpoint sources and technical assistance costs to implement the nonpoint source reductions required.

Cost estimates are provided for both nonpoint and point sources for each of the tributary strategy basins. The Rappahannock costs are broken down according to source category in the bar chart below. A more detailed summary is also provided (Table 5), showing the number of BMPs and amount of point source reductions for each basin. The total in Table 5 does not include the technical assistance costs included in the estimates above.

Cost Estimates By Source Category



Nonpoint Source Costs

The nonpoint source costs are based on structural costs to implement BMPs for the source categories: agriculture, urban, mixed open, septic and forest. The cost estimates considered structural costs to implement BMPs, costs for services to implement BMPs such as nutrient management planning, septic pumping, etc., and materials and equipment usage costs to implement BMPs such as the agronomic practices for agriculture (i.e., cover crops, and conservation tillage). Technical assistance costs were also calculated and added to the BMP cost to obtain the total implementation costs. (See Table 7) Maintenance costs were not included in the estimates.

The sources of information used to develop the cost estimates were as follows:

- Chesapeake Bay Program, Use Attainability Group Report, "Economic Analyses of Nutrients and Sediment Reduction Actions to Restore Chesapeake Bay Water Quality" (primary reference source). Urban BMP costs were taken from this source along with a small number of agricultural practices.

- Virginia's Agricultural Cost-Share Program Tracking Database, period of record was 1998-2002. Stream fencing practices were adjusted based on 2002 data.

- DCR’s staff was consulted for nutrient management costs, erosion and sediment control costs, and the cost to transfer poultry litter.

- Study by Virginia Polytechnic Institute and State University and the United States Department of Agriculture was used for the forest harvesting practices.

The cost for the septic BMPs – connection to public sewer and septic tank pumping were based on information from nonpoint source implementation projects funded by DCR. Costs for the installation of a septic denitrification system was based on the assumption that most of the systems accounted for in the tributary strategy would be for new construction as compared to replacement of failing conventional on-site sewage disposal systems. The average cost figure for a denitrification system is $12,565 and the average cost for a conventional system is $4,500. The difference of $8,065 was used to calculate the cost for the advanced treatment to obtain the additional nitrogen removal per system.

Point source costs

The point source capital costs are planning level, order-of-magnitude figures (accurate from -30% to +50%), based on a combination of owner-furnished data and results from an estimation methodology developed by the Chesapeake Bay Program's Nutrient Reduction Technology (NRT) Workgroup. This Workgroup included state and federal staff, several treatment plant owners, academia, and two experienced and respected consulting engineering firms. More accurate figures can only be determined through specific facility planning, design, and ultimately construction bids for the necessary treatment upgrades.

The NRT methodology included assumptions about treatment types, plant sizes, and needed unit processes, to reduce nitrogen and phosphorus in order to meet three annual average discharge performance "tiers":

- Biological Nutrient Removal (BNR): TN = 8.0 mg/l; TP = 1.0 mg/l
- Enhanced Nutrient Removal (ENR): TN = 5.0 mg/l; TP = 0.5 mg/l
- Limit-of-Treatment (LOT): TN = 3.0 mg/l; TP = 0.1 mg/l

It is recognized that if a particular treatment level is chosen to meet a basin load allocation in the year 2010, it is probable that more stringent treatment will be needed to maintain the reduced load into the future. This is the case where a plant has not yet reached its design capacity in the year 2010, but must "cap" its discharge load as flows increase.

The point source cost estimates were developed using the "tier" that most closely matched the proposed level of treatment in each tributary strategy planning area. As a result, it is possible that the cost figures are under-estimated. This is due to the fact that some plant owners could chose to install a more stringent treatment process now, to maintain a "cap" load at the design capacity, rather than meeting an interim 2010 load goal and potentially face multiple construction projects to retrofit their plant. The most conservative cost estimate (i.e., highest cost, associated with limit-of-treatment technology) was used only for the municipal plants in the northern Virginia portion of the

Potomac basin (excepting Upper Occoquan Sewage Authority), and municipal dischargers to the tidal-fresh portion of the Middle James basin (excepting Hopewell).

Table 5. Summary of Costs By Source Category

Rappahannock Basin Estimated BMP Cost Summary

Agricultural BMPs	Cost Units	Cost/Unit	Basin Costs
Conservation-Tillage	$/Acre	$3	$30,177
Forest Buffers	$/Acre	$545	$7,625,362
Wetland Restoration	$/Acre	$889	$0
Land Retirement	$/Acre	$928	$356,529
Grass Buffers	$/Acre	$175	$1,295,542
Tree Planting	$/Acre	$108	$1,180,656
Nutrient Management Plans	$/Acre	$7	$552,782
20% Poultry Litter Transport	$/Wet Ton	$12	$0
10% Livestock Manure Transport	$/Wet Ton	$12	$0
Conservation Plans	$/Acre	$7	$1,495,840
Cover Crops (Early-Planting)	$/Acre	$19	$0
Cover Crops (Late-Planting)	$/Acre	$19	$1,991,865
Off-Stream Watering w/ Fencing	$/Acre	$284	$10,556,432
Off-Stream Watering w/o Fencing	$/Acre	$152	$2,881,008
Off-Stream Watering w/ Fencing & RG	$/Acre	$186	$4,397,910
Stream Stabilization	$/Acre	$12	$0
Animal Waste Management	$/Acre	$32,278	$387,780
Yield Reserve	$/Acre	$30	$31,440
30% Poultry Phytase	N/A	$0	$0
Total Cost for Agricultural BMPs			**$32,783,323**

Point Source Reductions	Cost
Phosphorus Reductions	$945,681
Nitrogen Reductions	$46,490,492
Total Costs for Point Source Reductions	**$47,436,173**

Basin Total*	**$175,252,879**

*Does not include Technical Assistance

Urban BMPs	Cost Units	Cost/Unit	Basin Costs
Wet Ponds & Wetlands	$/Acre	$820	$7,508,740
Dry Det Ponds & Hyd Struct	$/Acre	$820	$0
Dry Ext Det Ponds	$/Acre	$820	$0
Urban Infiltration Practices	$/Acre	$820	$7,508,740
Urban Filtering Practices	$/Acre	$820	$7,508,740
Urban Stream Rest	$/Mile	$63,360	$0
Urban Forest Buffers	$/Acre	$108	$187,704
Urban Tree Planting	$/Acre	$108	$0
Urban Nutrient Management	$/Acre	$15	$908,880
Urban Growth Reduction	$/Acre	$22	$0
Erosion & Sediment Control	$/Acre	$2,500	$21,090,000
Total Cost for Urban BMPs			**$44,712,804**

Mixed Open BMPs	Cost Units	Cost/Unit	Basin Costs
Wetland Restoration	$/Acre	$889	$0
Tree Planting	$/Acre	$108	$0
Mixed Open Nutrient Management	$/Acre	$15	$2,913,825
Forest Buffers	$/Acre	$545	$3,016,575
Total Cost for Mixed Open BMPs			**$5,930,400**

Forest BMPs	Cost Units	Cost/Unit	Basin Costs
Forest Harvesting Practices	N/A	$21	$36,774
Total Costs for Forest BMPs			**$36,774**

Septic BMPs	Cost Units	Cost/Unit	Basin Costs
Septic Denitrification	$/System	$8,065	$37,397,405
Septic Pumping	$/System	$200	$6,956,000
Septic Connections	$/System	$1,500	$0
Total Cost for Septic BMPs			**$44,353,405**

Table. 6 6-Year Timeline, Annual Implementation Levels and Technical Assistance for Nonpoint Sources.

Date (year)	Agriculture (%)	Urban (%)	Mixed Open (%)	Septic (%)	Forest (%)	Ag. TA (%)	Urban, MO TA (%)	Septic, Forest TA (%)
1	10	15	10	15	15	10	20	5
2	15	15	15	15	15	10	20	5
3	15	15	15	15	15	10	20	5
4	20	15	20	15	15	10	20	5
5	20	20	20	20	20	10	20	5
6	20	20	20	20	20	10	20	5

Provided in the table above is a level of implementation based on a projected percentage of the total BMPs by source category that would have to be implemented yearly to achieve the tributary strategies by 2010. These percentages were used to project the structural costs on an annual basis for each of the nonpoint source categories to implement the tributary strategies. Also, included in the table is factors (expressed as a percentage) used to estimate the technical assistance costs to implement the tributary strategies. The agricultural technical assistance costs was based on 10% of the structural cost, the urban and mixed open (MO) technical costs were based on 20% of the structural costs, and septic and forestry technical costs were based on 5% of the structural cost.

The technical assistance costs are based on a uniform percentage over the six year implementation period. The percentages of yearly implementation of BMPs were adjusted to account for the expectation that the implementation levels in the earlier years will not be as great as compared to the later years due to an initial time lag. This is anticipated as a result of putting into place more technical assistance, making programmatic and regulatory changes, improving implementation reporting and tracking efforts, and obtaining substantial amounts of funding.

Table 7. NPS costs over a six-year period

Rappahannock River Basin							
	Imp Yr 1	Imp Yr 2	Imp Yr 3	Imp Yr 4	Imp Yr 5	Imp Yr 6	Totals
Agriculture BMPs	3.278	4.917	4.917	6.557	6.557	6.557	32.783
Urban BMPs	6.707	6.707	6.707	6.707	8.943	8.943	44.713
Mixed Open BMPs	0.593	0.890	0.890	1.186	1.186	1.186	5.930
Septic BMPs	6.653	6.653	6.653	6.653	8.871	8.871	44.353
Forest BMPs	0.006	0.006	0.006	0.006	0.007	0.007	0.037
Agriculture TA $	0.328	0.492	0.492	0.656	0.656	0.656	3.278
Urban & Mixed Open TA $	1.460	1.519	1.519	1.579	2.026	2.026	10.129
Septic & Forest TA $	0.333	0.333	0.333	0.333	0.444	0.444	2.220
Total Basin Estimated NPS Cost including Technical Assistance							143.443

* Cost in Millions of Dollars

IV. Implementing the Strategies: A Message from the Secretary of Natural Resources

This strategy and similar strategies prepared for Virginia's Chesapeake Bay tributaries propose a suite of nonpoint source best management practices, sewage treatment plant upgrades and other actions necessary to achieve the specified nutrient and sediment reductions. The analysis and practices contained in this strategy are an important first step and bring together state and regional goals informed by an understanding of local conditions as developed by the tributary teams. However, as the input decks outlined in the previous section of this document make clear, achieving the necessary implementation levels go far beyond what we have previously seen. In order for these strategies to be meaningful, we must identify what additional resources and tools are necessary to achieve and cap these nutrient reductions in the timeframe called for by the Chesapeake 2000 Agreement. We must also further refine these strategies with specific information regarding implementation budgets and timetables.

The citizens of Virginia should receive this clear message. Restoration of the Chesapeake Bay is possible but it will not come without substantial public and private resources and programs that ensure that management practices are adopted and maintained. Without such actions, the promises we have made have no meaning. Without such actions, the economic and environmental benefits of a restored bay will not be realized.

The tributary teams have raised a variety of issues regarding implementation, tracking and cost and those questions need to be addressed as we move forward. The purpose of this chapter is to build on those issues and outline in broad terms the implementation approach for these strategies. During the public comment period and beyond, the public is invited to offer comments and provide guidance on the issues and questions that follow.

Funding

Part Three of this strategy outlines the magnitude of funding necessary to address the various sources of nutrient and sediments. It is clear that implementation of these strategies will require financial resources that are far beyond those currently available. Governor Warner has proposed a dedicated source of funds for water quality improvement and land conservation, however the current stalemate in the state budget process has put the Governor's proposal as well as funds proposed by the Senate in doubt.

There is also activity at the regional level. The Chesapeake Executive Council has appointed a high level panel to address funding issues. Chaired by former Virginia Governor Gerald Baliles, the panel has begun its deliberations is expected to release its findings and recommendations in October 2004.

As part of its review of this and the other strategies, the public is invited to address the funding issue with suggestions on how additional funding can be obtained to implement this strategy. In the meantime, efforts to target existing resources will be pursued. These strategies provide the basis for evaluating the areas with greatest need.

Point source implementation

Implementation of point source reductions will be accomplished through completion of sewage treatment plant upgrades currently underway as well as final adoption of regulatory programs that are currently being developed by the Department of Environmental Quality.

Regulatory Programs Now Under Development

As described previously in this document, the EPA Chesapeake Bay Program Office published water quality criteria related to dissolved oxygen, water clarity and chlorophyll "a" that will serve as the basis for the revision of water quality standards for the states in the Chesapeake Bay watershed with tidal waters (Maryland and Virginia). The criteria, when achieved, will provide the habitat necessary to protect the bay's fish, shellfish, crabs and other living resources. A notice of intended regulatory action (NOIRA), the first step in the regulatory process to amend water quality standards, was published in the Virginia Register on November 17, 2003. The regulatory process prescribed by the Virginia Administrative Process Act is now underway. The public comment process on the proposed revisions to the standards should take place later this year.

In December 2003, Governor Warner announced the beginning of a regulatory process to establish a range of technology-based nutrient limits in discharge permits within the Chesapeake Bay watershed. The regulation will complement the water quality standards regulation and ensure that the nutrient reductions will occur. A NOIRA for this rulemaking has been published in the Virginia register and the regulatory process has begun.

These concurrent rulemakings will ensure that Virginia has the regulatory tools that define the water quality goals we are committed to achieving for the Chesapeake Bay and its tidal rivers and will serve as the basis for implementation of these strategies.

Accommodating Future Growth

The pollutant loads assigned to point and non point sources must be capped over time. The capacity of existing sewage treatment plants to handle future growth in their communities needs to be assured while at the same time not exceeding the load allocation caps for those particular plants or for an entire river basin. In addition, even if the point source regulation requires that all new plants must achieve limit of technology (LOT) treatment, there is a new load associated with even a LOT facility. Therefore, how can new or expanded treatment plants be accommodated?

Nonpoint source implementation

Nonpoint sources account for the majority of nutrients flowing into the Chesapeake Bay system and at the same time, because of their diffuse nature, they are the most difficult to control. There has been some success in addressing nonpoint sources, but the kind of comprehensive implementation necessary to improve water quality remains elusive. While existing programs, including cost-share programs on agricultural land and the Commonwealth's newly reorganized and expanded stormwater management law, will be brought to bear on nutrient and sediment pollution, better use of existing authorities and an examination of what mix of regulatory and voluntary programs are necessary must begin.

Comprehensive Management of Nutrients and Sediments on Land

The strategies rely heavily on adoption and implementation of nutrient management plans on both agricultural and urban lands. How can consistent and comprehensive application of nutrient management plans on both agricultural and urban lands be achieved?

Are there improvements that can be made to current agriculture nonpoint source control programs to better address nutrient issues? For example, nutrient management plans are currently required by poultry operations that use waste on their own lands. However, nutrient management plans are not required for those who use waste generated on other farms. How should this discrepancy be addressed?

Septic systems are currently an uncontrolled source of nitrogen. Should all newly installed septic systems and replacement systems be required incorporate processes to remove nitrogen from effluent?

Beneficial uses of animal and poultry waste must be more aggressively pursued. Value added products produced from animal or poultry waste or "waste to energy" facilities can help address nutrient issues. How can these approaches be broadly implemented in Virginia?

Buffers along streams and rivers have proven to be an effective practice to reduce nutrients and sediments. In addition to programs such as the Conservation Reserve Enhancement Program that establish buffers on agricultural lands, programs such as the Chesapeake Bay Preservation Act require buffers along perennial streams in Eastern Virginia. What can be done to accelerate the establishment of buffers along Virginia's streams and rivers?

The placement of sewage sludge (sometimes called "bio-solids") on agricultural lands is increasing. Are programs currently in place sufficient to address the impacts of this source of nutrients?

Land use

As these strategies recognize, the landscape is changing. Growth and development will alter the ratio of sources and conversions from less intensive land uses to more intensive uses will continue. These strategies recognize that new methods of land management, particularly low impact development practices, will need to be employed on a much larger scale. This approach must be pursued concurrently with improved enforcement of erosion and sediment control and other traditional land management practices.

How can these news land management practices become integral parts of local land use and land management programs particularly in areas outside those governed by the Chesapeake Bay Preservation Act?

Next steps

Although considerable efforts have gone into the development of this strategy, it is not complete. While we have identified the point and nonpoint source practices necessary to achieve our goals, a good deal of work with regard to the implementation of these practices remains to be done. Following the public comment period, these strategies will be supplemented with additional detail regarding implementation responsibilities, budgets and timetables. We must clearly show how each of the practices proposed can be implemented; first, by showing what existing programs can accomplish with known resources and second by showing what additional resources will be necessary to complete implementation. In addition, detailed progress reports will be made annually to the Governor, the General Assembly and the citizens of Virginia as part of the required annual report on Tributary Strategy implementation.

As the implementation of the strategies proceed, tributary teams and state agencies will assume the following responsibilities.

- Establish process to evaluate progress and success
- Establish specific timeline to achieve pollutant load allocations by 2010
- Guide and prioritize implementation activities
- Refine Input Deck as revised data become available
- Develop outreach initiatives and strategies
- Collaborate with watershed organizations to promote and guide implementation
- Help localities, Soil and Water Conservation Districts, Planning District Commissions and businesses with local and regional watershed planning

State agencies and the tributary teams will also work closely with Planning District Commissions and Soil and Water Conservation Districts and other partners in order to:

- Encourage local governments to adopt and maintain tracking systems to account for the establishment of urban best management practices
- Promote specific strategy components to localities
- Assist in the development and implemention of local watershed plans that support the strategy
- Encourage landowners to implement specific BMPs
- Provide to local governments the technical assistance and analysis of environmental data to support program development and implementation
- Provide technical GIS capability to support local programs
- Promote, coordinate and track agricultural and urban BMPs

- Facilitate consensus among localities in each PDC jurisdiction on strategy development, refinement and implementation

An interagency steering committee operating under the direction of the Secretary of Natural Resources coordinates state oversight of the tributary strategy process. The committee will:

- Re-evaluate strategies, as necessary following the adoption of new water quality standards and based on the scheduled 2007 re-evaluation by the Chesapeake Bay Program.
- Maintain clear lines of communication in state government
- Report on implementation through an annual report
- Better engage federal agency partners
- Prioritize Chesapeake 2000 Agreement commitments that facilitate or support tributary strategy implementation
- Identify data and map support needs
- Maintain and enhance state nonpoint source assessment and targeting information
- Target available funding resources
- Promote "government-by-example" activities, such as low impact design for state projects
- Provide ongoing support for local watershed planning activities
- Refine implementation timelines
- Ensure committee composition that includes needed expertise and comprehensive agency input

The challenge is now to turn these plans into reality and to continually refine them so they implement the most effective and efficient methods to achieve our ambitious goals.

Appendices

APPENDIX A: Water Quality Data and Trends

The Virginia Chesapeake Bay and its tidal tributaries continue to show environmental trends indicating progress toward restoration to a more balanced and healthy ecosystem. However, the Bay system remains stressed and some areas and indicators show continuing degradation. Progress in reducing nutrient inputs has made measurable improvements and it is expected that continued progress toward nutrient reduction goals, along with appropriate fisheries management and chemical contaminant controls, will result in additional Bay improvements. Findings from the last 18 years (1985 through 2002) of the monitoring programs are discussed in the sections below.

Nutrients (nitrogen and phosphorus) influence the growth of phytoplankton in the water column. Elevated concentrations of these nutrients often result in excessive phytoplankton production (i.e., chlorophyll). Decomposition of the resulting excess organic material during the summer can result in low levels of dissolved oxygen (D.O.) in bottom waters. These low D.O. levels can cause fish kills and drastic declines in benthic communities, which are the food base for many fish populations. Low-D.O. waters also adversely affect fish and crab population levels by limiting the physical area available where these organisms can live.

Phosphorus: Figure 1 presents current status and long term trends in phosphorus concentrations. Some of Virginia's Bay waters have the poorest conditions in relation to the rest of the Chesapeake Bay system. The status of other downstream segments of rivers are fair but, the mainstem Chesapeake Bay and the upper portions of the tidal rivers have relatively good conditions.

The “watershed input” stations shown in Figure 1 provide information about the success of nutrient control efforts. Results at these watershed input monitoring stations are flow-adjusted in order to remove the effects of river flow and assess only the effect of nutrient management actions (e.g., point source discharge treatment improvements and BMPs to reduce nonpoint source runoff). Several input stations show improving concentration trends, but unfortunately an improving trend at the Rappahannock watershed input station noted in a previous report was no longer present when the 2003 data were added to the analyses.

Nitrogen: Figure 2 presents status and long-term trends in nitrogen concentrations. As with phosphorus, management actions to reduce nitrogen have been effective as indicated by improving trends at many of the watershed input stations. Most of Virginia's Chesapeake Bay is also showing improving trends in nitrogen. The status of nitrogen in much of the Rappahannock River is considered relatively good, in comparison to conditions in the other major tributaries and the Virginia Chesapeake Bay.

Chlorophyll: Chlorophyll is a measure of algal biomass (i.e., phytoplankton) in the water. High chlorophyll levels are an indicator of poor water quality because they can lead to low D.O. conditions when the organic material sinks into bottom waters and is decomposed. High algal levels can also reduce water clarity, which decreases available light required to support photosynthesis in underwater grasses. High algal levels also can be indicative of problems with the food web such as decreased food quality for some filter-feeding fish and shellfish. Finally, high levels of chlorophyll may indicate large-scale blooms of toxic or nuisance forms of algae.

Figure 3 presents the current status and long term trends in chlorophyll concentrations. Parts of all of the major Virginia tributaries, including the Rappahannock, have poor status in relation to Bay-wide conditions. A degrading trend in chlorophyll was detected in the upper tidal fresh portion of the Rappahannock. The only improving trends were observed in the lower Potomac River and part of the Elizabeth River.

Dissolved Oxygen: Bottom dissolved oxygen levels are an important factor affecting the survival, distribution, and productivity of aquatic living resources. Figure 4 shows the current status and long term trends in dissolved oxygen concentrations. Status is given in relation to dissolved oxygen levels supportive or stressful to living resources. About half of the Virginia Chesapeake Bay and smaller portions of the tidal tributaries had only fair status. The lower Rappahannock River and northernmost Virginia Chesapeake Bay segments are indicated as poor or fair status, partly because of low D.O. concentrations found in the mid-channel trenches. These mid-channel trenches have naturally lower D.O. levels, but the area affected and duration of low dissolved oxygen levels has been made worse by anthropogenic nutrient inputs.

There are scattered areas of improving conditions for dissolved oxygen and no areas of degrading trends. All of the tributaries have areas of improving conditions. These improvements are a result of both the nutrient management efforts and natural factors, such as declining river flow, which in turn has lead to less nutrient inputs and concurrently higher influxes of cleaner oceanic water.

Figure 1) Total Phosphorus Status and Trends

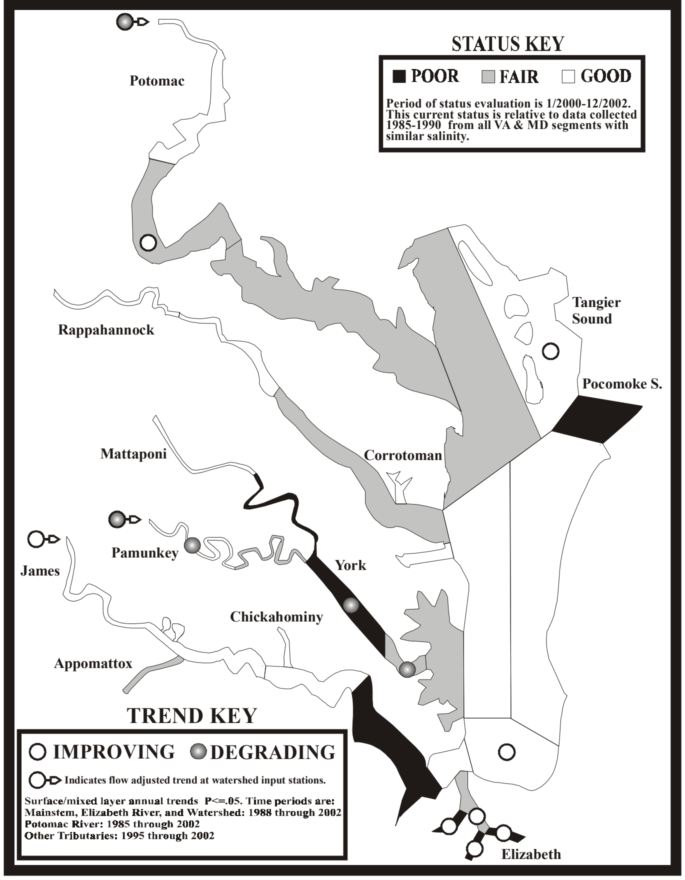


Figure 2) Total Nitrogen Status and Trends

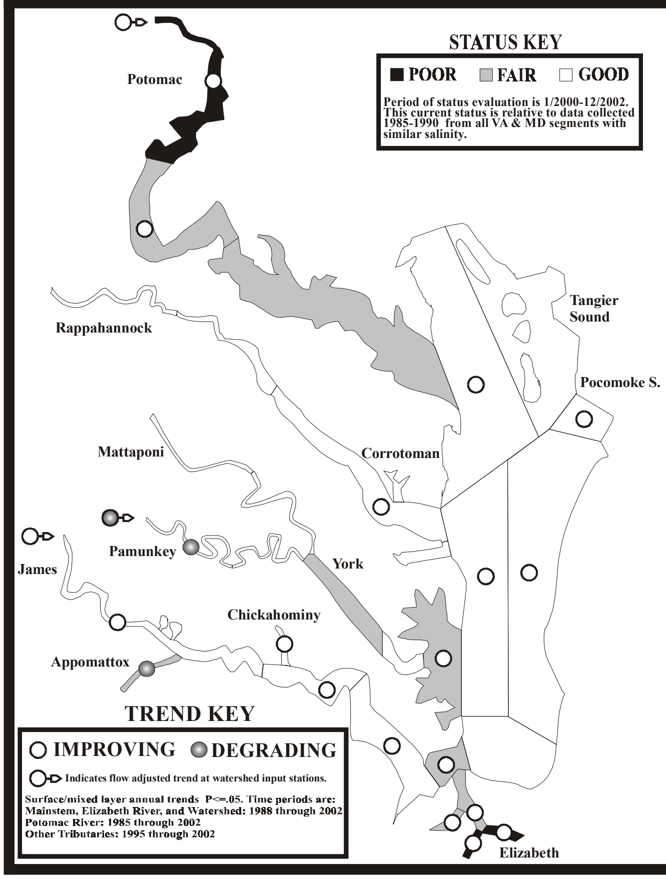


Figure 3) Chlorophyll Status and Trends

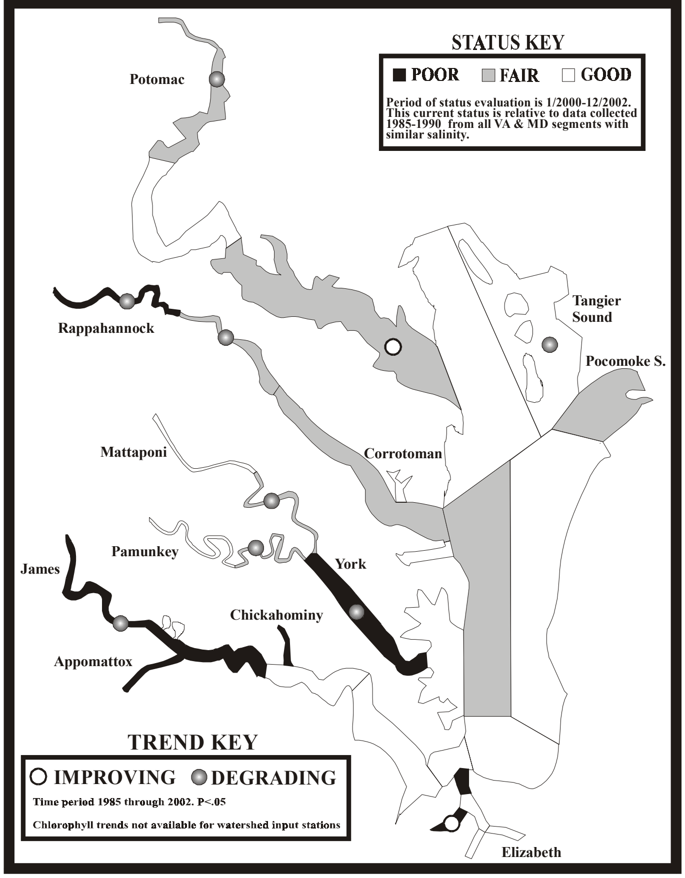
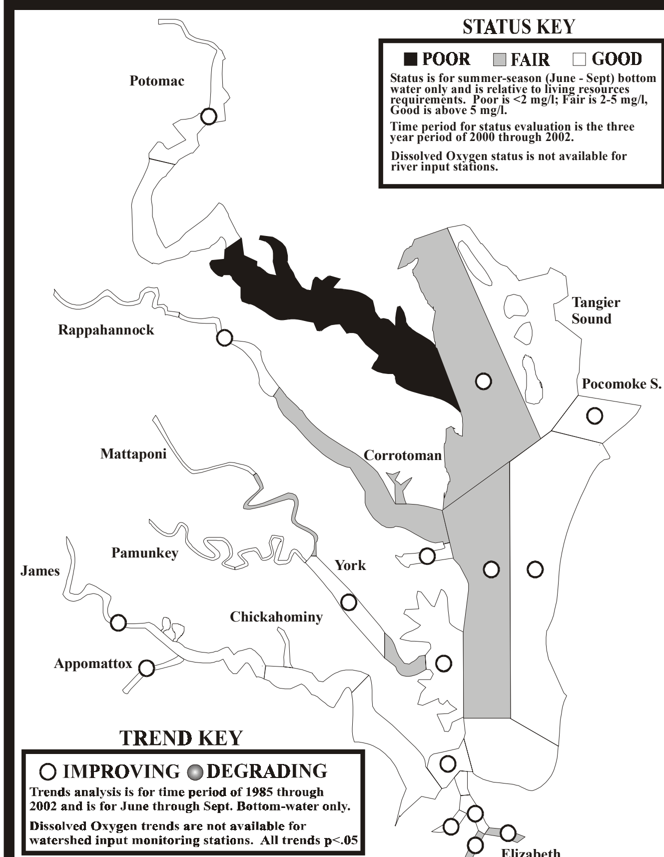


Figure 4) Dissolved Oxygen Status and Trends



Water Clarity: Water clarity is a measure of the depth to which sunlight penetrates through the water column. Poor water clarity is an indication that conditions are inadequate for the growth and survival of underwater grasses. Poor water clarity can also affect the health and distributions of fish populations by reducing their ability to capture prey or avoid predators. The major factors that affect water clarity are: 1) concentrations of particulate inorganic mineral particles (i.e., sand, silt and clays), 2) concentrations of algae, 3) concentrations of particulate organic detritus (small particles of dead algae and/or decaying marsh grasses), and 4) dissolved substances which "color" the water (e.g., brown humic acids generated by plant decay). Which of these factors most greatly influence water clarity varies both seasonally and spatially.

Figure 5 presents the current status and long term trends in water clarity. The status of many segments within the tributaries and the Chesapeake Bay mainstem are only fair or poor, including the tidal fresh and middle portions of the Rappahannock. This suggests that poor water clarity is one of the major environmental factors inhibiting the resurgence of underwater grasses in Chesapeake Bay. Degrading trends in water clarity were detected over a wide geographic area within Virginia's tributaries and Chesapeake Bay, including the Corrotoman basin. These degrading trends represent a substantial impediment to the recovery of grass beds within Chesapeake Bay. Possible causes of the degrading trends include increased shoreline erosion, as a result of waterside development, loss of wetlands, increased abundance of phytoplankton, or a combination of sea level rise and land subsistence.

Suspended Solids: Suspended solids are a measure of particulates in the water column including inorganic mineral particles, planktonic organisms and detritus which directly controls water clarity. Elevated suspended solids can also be detrimental to the survival of oysters and other aquatic animals. Young oysters can be smothered by deposition of material and filter-feeding fish such as menhaden can be negatively affected by high concentrations of suspended solids. In addition, since suspended solids are comprised of organic and mineral particles that may contain nitrogen and phosphorus, increases in suspended solids can result in an increase of nutrient concentrations.

Figure 6 presents the current status and long term trends in suspended solids concentrations. All of the major Virginia tributaries have segments that are fair or poor status, including the tidal fresh portion of the Rappahannock. No statistically significant trends were detected in the Rappahannock.

Figure 5) Water Clarity Status and Trends

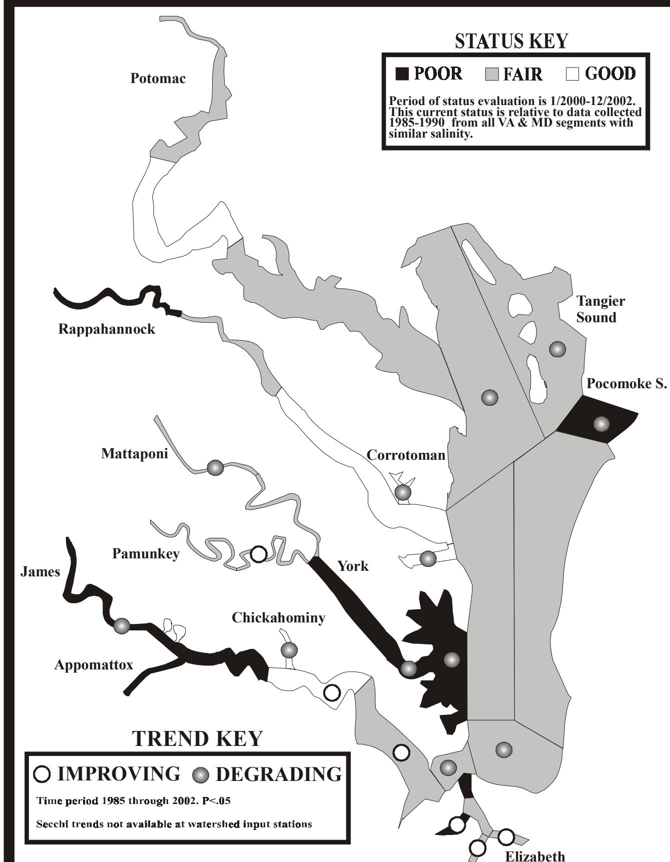
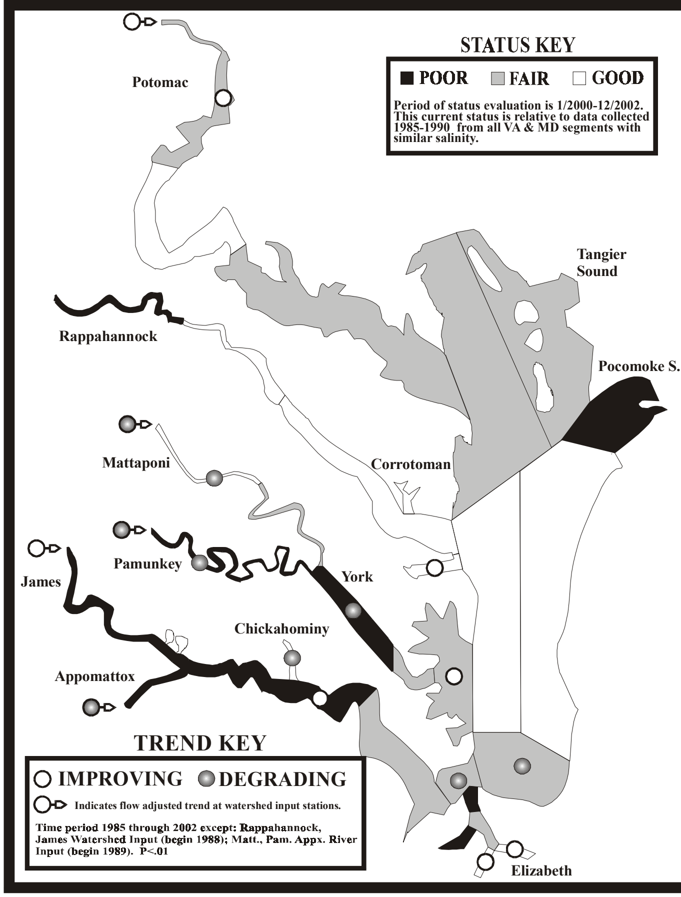


Figure 6) Suspended Solids Status and Trends



APPENDIX B: Building on Accomplishments

The Bay Program partners established the year 1985 as the baseline from which all nutrient and sediment reductions would be calculated resulting from implementation of BMPs. Several significant benchmark years have been identified to include 1996 and 2001. 1996 was used as the benchmark year for the original tributary strategy and 2001 is the benchmark year for the revision process. The findings of these evaluations indicate that the voluntary implementation of BMPs resulted in meaningful and tangible progress in all sectors. However, as the benchmark years indicate, the rate of implementation and associated reductions are not sufficient to reach the recently established load allocations.

As of 2000, about 90 percent of the nutrients emptying into the Rappahannock were coming from nonpoint sources, including surface runoff from farms, residential lands and other urban areas, with the remaining ten percent coming from point sources, such as wastewater treatment and industrial plants. A suite of point and nonpoint management measures was recommended to reduce the nutrients and sediment polluting the Rappahannock. Today, this has shifted to approximately 93 percent of the nutrient load originating from nonpoint sources, while the remaining seven percent coming from point sources. This is due primarily to the upgrades at wastewater treatment facilities throughout the watershed.

From 1985 to 2000, Rappahannock stakeholders reduced nitrogen by 18 percent, phosphorus by 26 percent, and sediment by 20 percent. Significant reductions were realized during this period through both point and nonpoint source pollution control programs. As observed in Figure 6, the progress from 1985 to 2000 is roughly equivalent to the additional effort needed to achieve the new goals by 2010.

Table 1: Rappahannock Nutrient and Sediment Allocations

	1985 Load	2000 Load	Cap Load	Additional Reduction To Meet Cap
Nitrogen (lbs)	9,731,632	7,976,338	**5,238,771**	2,737,567
Phosphorus (lbs)	1,271,262	941,954	**620,000**	321,954
Sediment (tons)	417,914	336,421	**288,498**	47,923

Wastewater treatment plant operators, local governments, landowners, watershed groups, businesses, and citizens have made significant progress since the original strategy was completed in 2000. This revised strategy has accounted for this progress and is intended to build upon specific successes in the Rappahannock. In particular, the Rappahannock stakeholders have made significant progress toward establishing and sustaining low impact development. This new strategy accounts for and continues to advance this movement in the Rappahannock watershed.

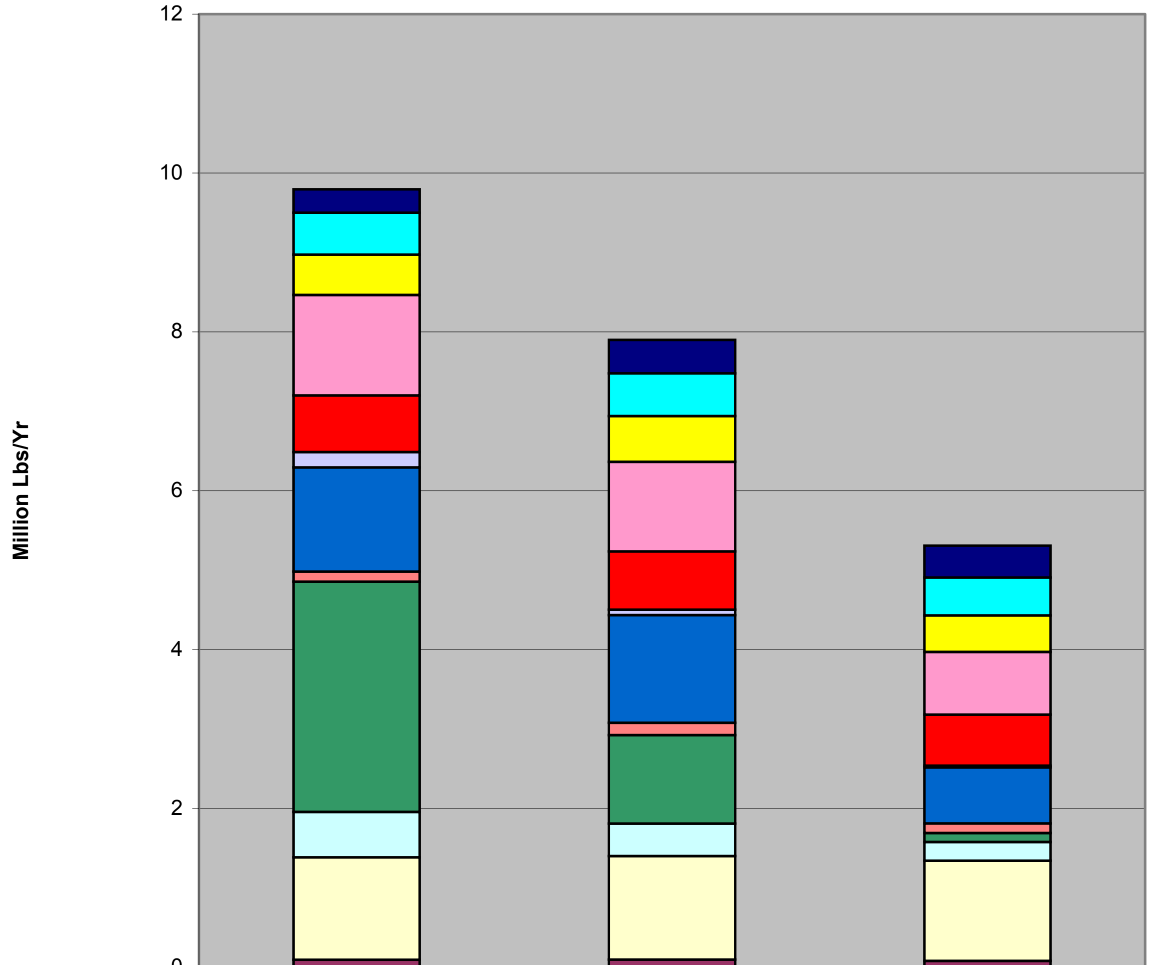
Rappahannock watershed stakeholders, who have been on the forefront of efforts Bay-wide to implement Low Impact Development (LID), have now made LID the cornerstone of urban practices outlined in the Rappahannock Tributary Strategy. Due to the nature and success of cooperative partnerships between conservation organizations, state and local agencies, and businesses, the Rappahannock basin has seen significant accomplishments in establishing low impact development throughout the Rappahannock watershed.

Stafford County recently passed new stormwater and subdivision codes, which removed "roadblocks" to LID. It also adopted specific LID design criteria and created innovative incentives for developers to use the LID approach. The Town of Warsaw also passed amendments to its Development Management Ordinance requiring LID as the standard approach for new development. Other localities in the basin are in the process of considering LID code amendments.

Agricultural BMP implementation was exceptional between 1985 and 2000. Generally, signup at soil and water conservation districts is higher than available funds. With increased funding, implementation would substantially improve. As indicated in the charts below (figures 7,8,9) significant nitrogen reductions have occurred in the agricultural sector, especially in regards to practices on cropland. Likewise, significant phosphorus reductions have been realized as well. Much of the reductions have come from point source upgrades; however, agricultural practices have also effectively reduced phosphorus loads. Sediment loadings have also decreased with the majority of the reductions coming from BMPs on crop and pasture lands. Conversely, urban areas have experienced load increases for all three pollutants.

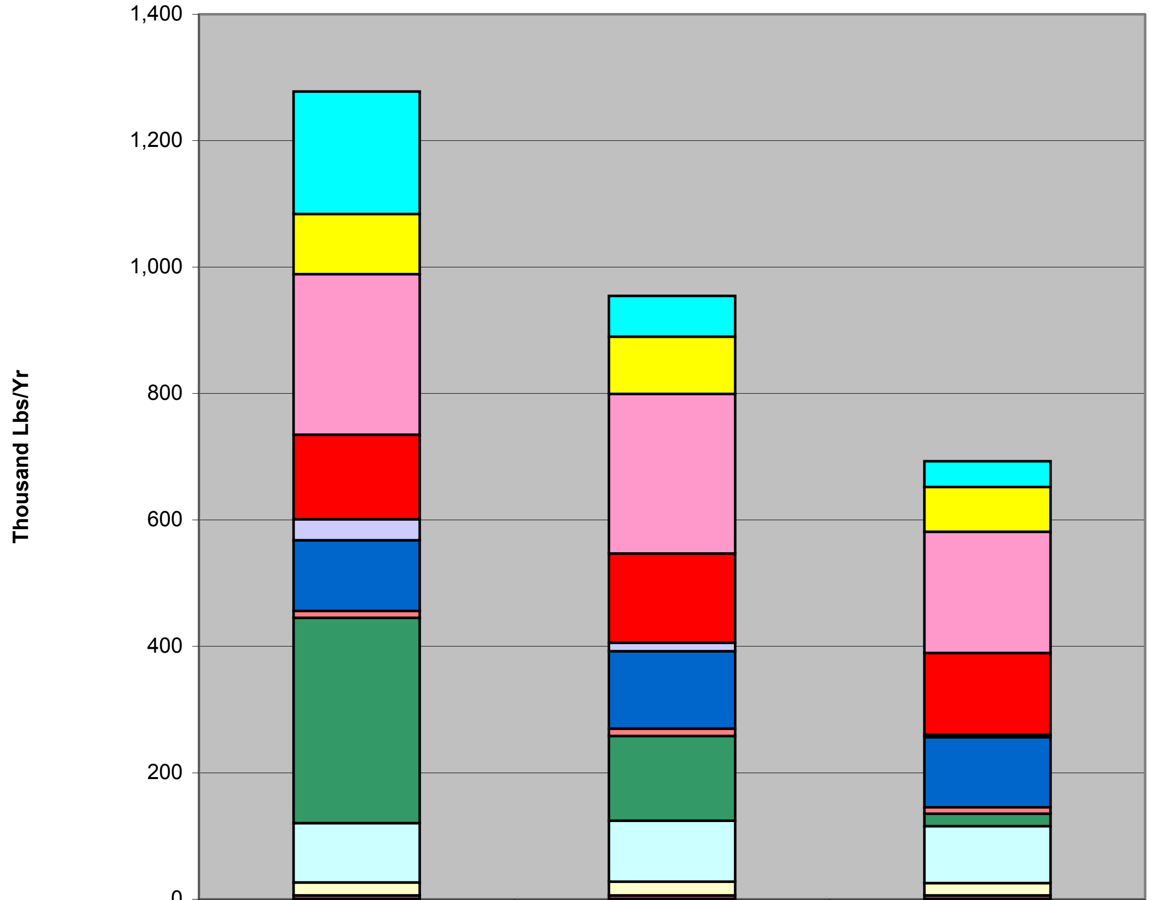
In developing a strategy to reduce nitrogen, phosphorus, and sediment loadings, it is imperative to identify the sources of the pollutants. Although the loads are decreasing, the majority of the loadings continue to originate on agricultural lands. It is also critical to identify additional areas in which to focus efforts. In the Rappahannock, urban and mixed open lands have grown in acreage, and subsequently, have experienced increased loadings.

Figure 7: Total Nitrogen by Source Category



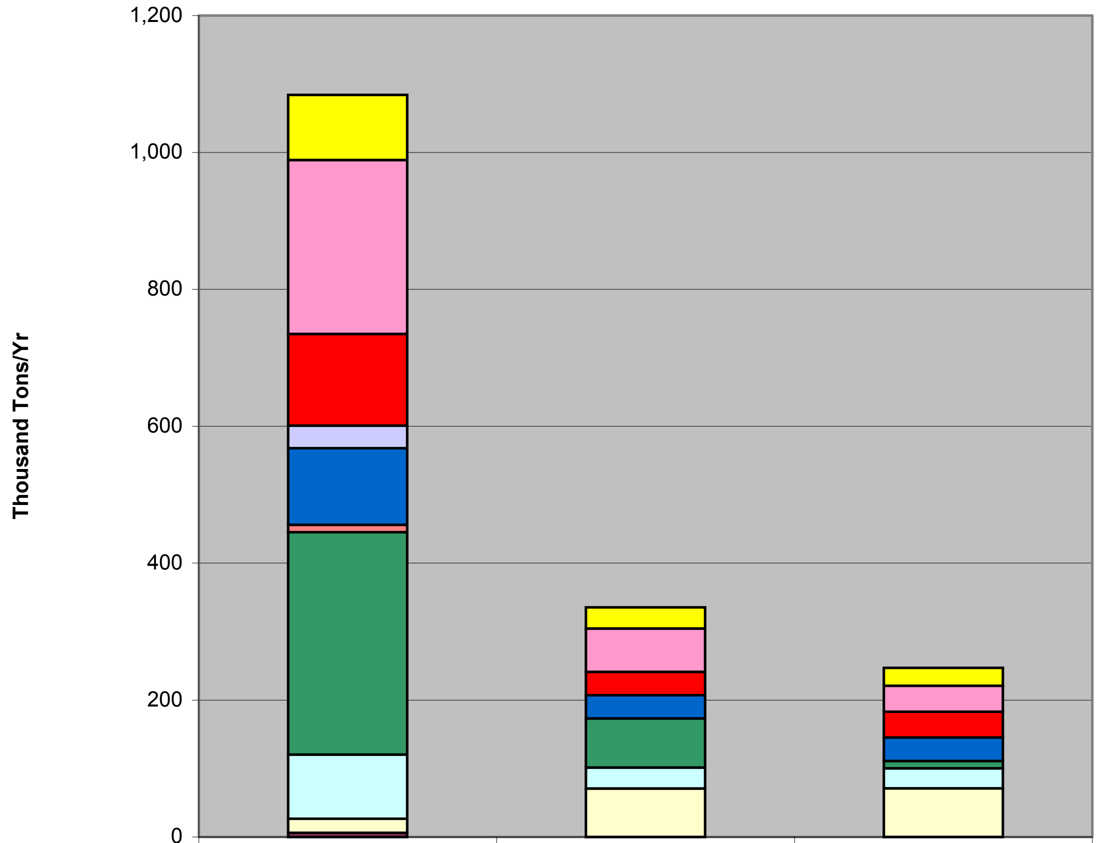
	1985	2002	2010
Septic	293,164	420,747	401,757
Point Source	527,878	538,466	477,765
Perv Urban	506,858	575,070	458,993
Pasture	1,265,664	1,129,102	788,198
Mixed Open	713,786	731,479	643,019
Manure	192,334	68,587	21,677
Low Till	1,311,970	1,357,039	705,348
Imp Urban	125,728	153,917	121,736
High Till	2,898,957	1,114,612	112,674
Hay	571,114	409,213	234,932
Forest	1,289,426	1,302,763	1,261,384
AtDep Water	97,123	98,253	82,221

Figure 8: Total Phosphorus by Source Category



	1985	2002	2010
Septic	0	0	0
Point Source	193,580	64,418	40,829
Perv Urban	95,151	90,613	70,919
Pasture	254,129	252,501	191,697
Mixed Open	133,906	141,342	129,074
Manure	33,126	13,191	4,101
Low Till	111,864	122,345	110,649
Imp Urban	10,910	11,679	10,184
High Till	324,613	134,010	19,883
Hay	93,822	96,538	89,855
Forest	20,565	21,627	19,528
AtDep Water	6,006	6,095	6,153

Figure 9: Total Sediment by Source Category



	1985	2002	2010
Septic	0	0	0
Point Source	0	0	0
Perv Urban	95,151	30,882	26,155
Pasture	254,129	63,040	37,708
Mixed Open	133,906	34,053	37,664
Manure	33,126	0	0
Low Till	111,864	33,900	34,472
Imp Urban	10,910	0	0
High Till	324,613	71,905	10,790
Hay	93,822	30,682	29,072
Forest	20,565	70,721	71,138
AtDep Water	6,006	0	0

APPENDIX C: Rappahannock Tributary Strategy Team Recommendations

- The strategy should allow for nutrient reductions from cover crops that are harvested.
- Re-evaluate assessments on property that comprise Resource Protection Area buffer areas. Currently they are assessed as farmland and probably should be assessed as recreational lands. Offer property and income tax incentives from local and/or state government to install BMPs especially for those farmers who have not historically participated in cost-share programs.
- More flexibility in the BMP specifications to count voluntary BMPs and to improve implementation rates (e.g. more flexible stream fencing specifications would be as effective, less costly, and would permit us to capture greater implementation rates).
- BMPs currently without efficiency rates (e.g. continuous no-till) should be further researched and approved to gain additional nutrient reductions. Long-term no-till should be given greater nutrient reduction values than other conservation tillage practices.
- The strategy should allow for nutrient reductions from voluntary streamside fencing and other practices that do not meet Natural Resource Conservation Service or DCR practice specifications but still provide nutrient and erosion reductions. Develop a procedure to track voluntary BMPs through farmer surveys and other means.
- The strategy should allow for nutrient reductions from wildlife planting practices.
- Count land conversions from farmland to permanent wildlife habitat towards nutrient reductions (e.g. US Fish & Wildlife Service initiative). Establish a system for tracking land conversions.
- Expand the Poultry Litter Transport Program to help achieve additional reductions.
- Better targeting and promotion of high priority BMPs.
- Establish a large-scale manure transport program supported by the state.
- Establish a cost-share practice to fund submerged aquatic vegetation plantings.
- Piggyback any additional incentive with conservation reserve enhancement program (CREP) to cost-share 100 percent of the installation costs as well as an increase in the land rental rate of cropland conversion to forested or grassland buffers through CREP.
- Seek out financial resources to support a stronger environmental education initiative in Virginia. Improve education, marketing, and information for soil and water conservation.
- Organize a promotional program in the Bay watershed for the establishment of conservation easements.
- Include additional staff to carryout expanded level of BMP implementation work.
- Re-establish private plan-writer nutrient management plan cost-share program.
- Expand urban nutrient management program by providing funding for additional nutrient management planning staff.
- Investigate why urban BMPs have not been tracked historically and develop a procedure to do so to help lessen the burden on farmers.

- Conduct comparative monitoring of urban/suburban watersheds to assess true water quality impacts from these two land uses in Virginia. From this effort or if this data already exists, widely distribute the results to help conservationists sell the need of BMPs in each type of land use.
- Implement county level urban/suburban nutrient management programs. Provide free soil analysis.
- Investigate whether or not there is a viable program that financially addresses failing septic systems. If there is not a program, establish one.
- Implement county level septic tank pump out programs.
- Develop an implementation tool to ensure that Tributary Strategy goals are met. This would provide districts with the ability to account for and track load reductions within their district boundaries.

The Rappahannock Tributary Team also recognizes a number of implementation opportunities to complement those efforts outlined in Section IV. These are listed below.

Tributary Team Opportunities

- Develop list of goals, objectives, and actions to achieve strategy implementation
- Establish evaluation process to objectively evaluate progress and success
- Establish timeline to achieve individual goals and objectives and to reach water quality goals by 2010
- Guide and prioritize implementation
- Refine Input Deck with revised data as it becomes available
- Development outreach initiatives and strategy
- Collaborate with watershed organizations to promote and guide implementation
- Assist localities, planning district commission, soil & water conservation districts, and businesses in local/regional watershed planning
- Disaggregate input deck to local level
- Develop list of funding alternatives

Planning District Commissions/Soil & Water Conservation Districts

- Encourage local governments to adopt and maintain urban BMP tracking mechanism
- Promote specific Strategy components to localities
- Assist localities in developing and implementing local watershed plans that contribute to Tributary Strategy
- Directly encourage landowners to implement specific BMPs
- Provide technical assistance to local governments and analysis of environmental data to support program development and implementation
- Provide technical GIS capability to support local programs
- Take one of the lead roles in promoting, coordinating and tracking agricultural and urban BMPs
- Facilitate consensus among localities in each PDC jurisdiction on strategy development, refinement and implementation

Over the past several years, Rappahannock Watershed stakeholders have developed a significant infrastructure to shape and guide water quality programs and Tributary Strategy implementation in a consistent and effective manner. The Rappahannock River Basin Commission (RRBC) and the Rappahannock Conservation Council have been instrumental in tributary strategy development, review, and implementation. The Rappahannock Conservation Council has established an Urban/Suburban and an Agricultural/Forestry workgroup to review the original tributary strategy and to establish implementation priorities for local governments and soil and water conservation districts. The Rappahannock River Basin Commission provides the link between local governments and conservation partners throughout the watershed. The Commission has been instrumental in promoting and encouraging implementation at the local level. The Rappahannock Tributary Team, established during this process, will provide another link between these various organizations and will be a link to local governments, environmental organizations, and businesses.

The Rappahannock Tributary Team will be maintained to guide, review progress, and prioritize ongoing implementation. As technologies change, revised data are available, and new practices are adopted, the tributary team will be in the position to promote specific practices to all stakeholders. The team will have the primary directive of reviewing and revising components of the strategy, as appropriate. The team will also have the responsibility to prioritize and guide implementation. It is understood that specific BMPs are most appropriate for a specific region. The team will have the ability to evaluate these specific BMPs, promote greater research, encourage the Chesapeake Bay Program to adopt these measures, and encourage implementation throughout the watershed.

To meet the demanding goals of the tributary strategy, all stakeholders and landowners will need to be involved at varying levels of implementation. As much of the strategy is dependent upon local governments adoption and establishment of specific practices, much of the marketing and promotion efforts will be aimed at the localities. Effective implementation will rely largely on the ability to focus and target this message to local governments. The tributary team will develop the message and will assist planning district commissions and soil and water conservation districts to convey the message to localities.

The Rappahannock watershed is also fortunate to have the Rappahannock River Basin Commission, which is composed of both local and state officials. The structure of this organization facilitates quick and effective dissemination of tributary strategy components to local governments throughout the watershed. Through the DCR Regional Manager, the tributary team will receive input and provide progress reports to the Rappahannock River Basin Commission.

As implementation continues and more refined land use and land cover data becomes available, the tributary team will revise the input deck to better reflect existing conditions. A more accurate and defined implementation strategy can be developed at a regional or local level to account for these updates. It is envisioned that the tributary team will hold responsibility for revising the basin wide implementation plan and provide assistance to the localities in devising specific local plans.

A goal of the RRBC and other organizations in the Rappahannock watershed is to define this tributary strategy for localities. The DCR Regional Manager, in conjunction with the tributary team, will disaggregate the input deck and establish goals by locality. This disaggregated input deck would then define a specific set of load allocations, reduction goals, and a suite of practices for each locality. The DCR Regional Manager and the tributary team will work directly with local government staff and officials to refine this suite of BMPs to establish an effective and usable implementation mechanism for each locality.

Implementation timeline needed

The Rappahannock Tributary Team asserted that this strategy must hold responsible parties accountable for successful implementation and that it must provide specific responsibilities to government agencies federal, state, local, and regional. A consistent message throughout this process has been that the state must make a concerted effort to engage local officials and make them fully aware of the roles, responsibilities, and impacts of each locality. Therefore, specific "local" loads need to be developed and outlined to each locality.

One of the most critical elements will be for the state to actively engage and guide adoption and implementation of specific strategy components by the local governments. DCR will lead this effort and will actively pursue many of these items, while providing responsibility to the Tributary Team and the appropriate stakeholder.

APPENDIX D: Outreach/Educational Program

Throughout the development process, the Rappahannock Tributary Team agreed that to have a successful Strategy, a defined educational strategy must be included. This section outlines the necessary components to promote and implement the Strategy.

A process by which all citizens are educated as to their potential impact on water quality is critical to the successful implementation of the Rappahannock Tributary Strategy. Educational opportunities and programs will be formulated using the cooperative extension model of program development. These programs will utilize stakeholder input and involvement, which will lead to a sense of empowerment and responsibility by all participants. This will result in farmers, householders, landowners, and local elected officials making management decisions and lifestyle changes to reduce non-point source pollution. In addition to funding educational programs, there should be funding for public relations and promotional efforts to expand the awareness of the general public and to point out the issues and offer solutions that people can understand.

General public education and awareness-The primary goal is to make the average person aware of their role in the successful implementation of the Strategy.

- Water Quality and Watershed Monitoring - Assist people in assessing levels of degradation of local streams and waterways and helps them find effective solutions to any identified water quality problems.
- Domestic Animal Waste Control - Educate the public about animal waste controls and what to do with animal wastes.
- Household and Home Maintenance Education - Identify activities responsible for pollution and alternative actions or solutions especially with wastewater, septic systems and wells.
- Lawn and Garden Care Education - Address best management practices for both residents and lawn care companies. Major objective is to address pollution resulting from improper application rates and timing of pesticides and fertilizers.
- Storm water management-alternatives to traditional guttering and channelization—Low Impact Development, bio-retention areas, rain gardens, swales, rain barrels, pervious walkways and drives.

APPENDIX E: Rappahannock Tributary Team and meeting dates

Name	Organization	Ag. Com.	PS Com.	Urban Com.
Adams, Alexander	CBLAD			✔
Baker, Kathy	Stafford County			
Banks, Terry	Fort A.P. Hill - Wilcox			
Barber, John C.	Northern Neck SWCD	✔		
Bell, John	Tri-County/City SWCD	✔		
Bennett, Melvin	Spotsylvania County			✔
Berger, Junius	Northern Neck SWCD			
Blythe, Kevin	DOF			
Bos, Bob	Stafford County			
Boyer, Bruce	Spotsylvania County	✔		
Brann, Craig	Three Rivers SWCD	✔		
Calhoun, Laverne	Tidewater SWCD			
Carshult, Christer	Fauquier County			
Carter, Michelle L.	Three Rivers SWCD	✔		
Chambers, John	John Marshall SWCD	✔		
Conboy, Danielle				
Conboy, Kyle	King George County	✔		
Conner, Sharon L.	Hanover-Caroline SWCD	✔		
Corbin, Jeff	Chesapeake Bay Foundation			
Critzer, Harry	Little Falls Run WWTP	✔		
Cross, Debbie	DCR	✔		
Crowther, Joan C.	DEQ			
Cumbia, Dean	DOF	✔		
Davis, Wayne	DCR			
DeGive, Jolly	Piedmont Env. Council			
Durrett, Barney				
Edwards, Chris	Spotsylvania County			✔
Edwards, Michelle	DCR			✔
Faha, Tom	DEQ		✔	
Fawcett, Doug	Fredericksburg			
Fields, Pete	Stafford County			
Fisher, Gef	Fort A.P. Hill - Wilcox		✔	
Frazier, Gladys				
Frazier, William R.	John Marshall SWCD			
Fuss, David	Middle Peninsula PDC			
Garner, Joe	DCR	✔		
Grzeika, Joe	King George County			
Hawley, Brian	VDOT			
Hertzler, P.E., Shelby	DCR			
Hilliard, Kandy	Stafford County			
Hubble, Steve	Stafford County			✔
Hust, James				
James, Eldon	Rappahannock River Basin Commission			
Jett, Chris	Richmond County			
Johnson, Sam M.	VCE			
Kendall, Deborah turm	Orange County			
Kennedy, John	DEQ		✔	
Krick, Jennifer	John Marshall SWCD			

Name	Organization	Ag. Com.	PS Com.	Urban Com.
Lacatell, Andrew D.	Nature Conservancy			
Latane, William C.	Virginia Farm Bureau Federation	✔		
Lee, Warren	Culpeper SWCD	✔		
Lee, Mike	DCR			✔
Lightburn, Christa	Culpeper SWCD	✔		
Madson, Gary K.	Culpeper SWCD			
Manster, Stephen H.	RADCO			
Markham, Hugh	Tidewater RC&D			
Martyn, Sabrina	Orange, Town of			✔
May, Julie	DCR			✔
McCarthy, John W.	Rappahannock County			
McCauley, Joseph	U.S. Fish and Wildlife Service			
Mckenzie, Stuart	Northern Neck PDC	✔		
McLearen, Sam	Culpeper County			
Nelson, Erik	Fredericksburg, City of			
Pattie, Dudley M.	Rapidan Service Authority		✔	
Rae, Scott	Tidewater SWCD	✔		
Ramsay, Allen	Caroline County			
Rice, John	Piedmont Environmental Council/Hughes River Group			
Ritschel, Kim				
Robinson, Bob	Omega Seafood Co.		✔	
Saphir, Mac	VCE	✔		✔
Slaydon, P.E., Thomas	Spotsylvania County		✔	
Slusser, John	Warsaw			
Smith, Michael	Stafford County			
Snoddy, Thomas	Department of Forestry			
Staubitz, Ward	USGS			
Street, Richard	Tri-County City SWCD			✔
Sturman, Jeff	Rappahannock-Rapidan RC	✔		
Tabulenas, Theresa	Northern Neck SWCD			
Thomas, Bryant	DEQ			
Thompson, Joe	USDA, NRCS	✔		
Tignor, Troy	Spotsylvania County			✔
Tippett, John P.	Friends of the Rappahannock			✔
Tyrrell, Pat	RC&D			
Walker, Jeffrey	Rappahannock-Rapidan RC			
Waterhouse, Catherine	John Marshall SWCD			
Whiddon, Micqui	Northern Neck PDC			
Whitehead, Carey	Piedmont Env. Council			
Wichelns, Greg	Culpeper SWCD			✔
Wittman, Rob	Rappahannock River Basin Commission			

Rappahannock Tributary Team Meetings

Kick Off Meeting: July 29, 2003
King George Board of Supervisors Chambers

September 16, 2003
Germanna Community College, Fredericksburg Campus

October 28, 2003
Germanna Community College, Fredericksburg Campus

November 18, 2003
Rappahannock Area Development Council (RADCO)

December 2, 2003
Rappahannock Area Development Council (RADCO)

December 15, 2003
Rappahannock Area Development Council (RADCO)

January 6, 2004
Rappahannock Area Development Council (RADCO)

February 24
Rappahannock Area Development Council (RADCO)

March 15
Central Rappahannock Regional Library, Fredericksburg

April 12
Central Rappahannock Regional Library, Fredericksburg